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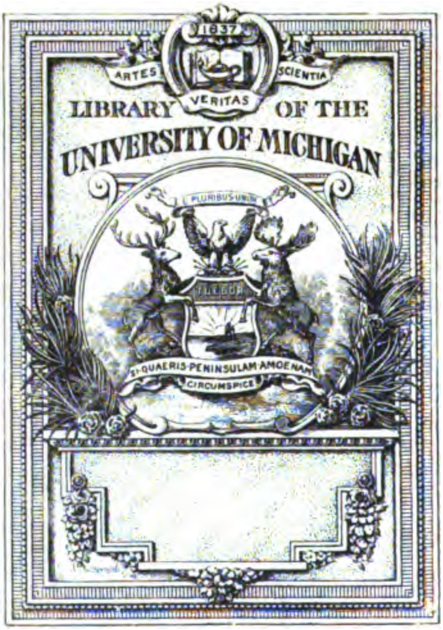
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PHARMACOGRAPHIA INDICA.

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A

HISTORY
OF THE PRINCIPAL DRUGS
OF VEGETABLE ORIGIN
MET WITH IN
BRITISH INDIA,

BY

WILLIAM DYMOCK,
BRIGADE-SURGEON, RETIRED,
LATE PRINCIPAL MEDICAL STOREKEEPER TO GOVERNMENT,

C. J. H. WARDEN,
SURGEON-MAJOR, BENGAL ARMY,
PROFESSOR OF CHEMISTRY IN
THE CALCUTTA MEDICAL
COLLEGE,

AND

DAVID HOOPER,
QUINOLOGIST TO THE GOVERNMENT OF MADRAS,
OOTACAMUND.

Vo. 3.

PARTs ~~VI~~. 5 & 6

and

London:—KEGAN, PAUL, TRENCH, TRUBNER & Co., Ld.
Bombay:—EDUCATION SOCIETY'S PRESS, BYCULLA.
Calcutta:—THACKER, SPINK & Co.

1893.

REGISTERED UNDER ACT XXV. OF 1867.

BOMBAY:
PRINTED AT THE EDUCATION SOCIETY'S PRESS, BYCULLA.

3801

Dr. William Dymock.

In issuing the sixth part of the "Pharmacographia Indica," it is with much regret we have to announce the death of the senior author. This sad event, caused by influenza combined with cystitis, took place on the 30th April 1892, at his residence on Malabar Hill, Bombay, in the fifty-eighth year of his age. William Dymock belonged to the west of England, and was educated first at Bristol, then at Rugby, and afterwards at Oxford where he took a B.A. degree. After a course of medical studies, he became M.R.C.S. Eng., he then joined the Indian Medical Service, and was appointed to the Bombay Presidency in 1857. He saw active service during the Mutiny with the Kathiawar Field Force against the Wagheers, and was present at the capture of Dantal Hill. For two years he was attached to the Indian Navy, and visited the ports of the Persian Gulf and the East African Coast. In 1868 he served on the Committee for publishing the Pharmacopœia of India, and at the time he was Acting Resident Surgeon at the European General Hospital. After taking two years' furlough to England he was appointed in 1871 to be Principal of the Medical Store Department, Bombay, and in this capacity he laboured for nearly twenty years, until his retirement from the service on 30th April 1890. During this time he devoted all his energies to the study of materia medica and pharmacy. He largely increased the local manufacture of galenical preparations, and introduced modern and improved machinery in the Depôt laboratory. For his skilful and efficient management he was thanked by Government on three separate occasions. Dr. Dymock was proficient in Arabic, Persian, Sanskrit, Hindustani, Mahratti and Guzrati; he was familiar with Greek and Latin, and corresponded freely in French, German and Portuguese. He was a Fellow and Examiner of the University of Bombay, and being an eminent linguist he was for many years a member of the Presidency Board for the examination of officers in Oriental languages. Bombay being the drug market of the East, he availed himself of the many opportunities of examining new and rare vegetable products, and having a good knowledge of botany, he was often able to identify the sources of the drugs. He was for some years Professor of Materia Medica in the Grant Medical College, and, as a teacher of this science, he was said not to have a rival in India.

Dr. Dymock's literary contributions to the *Pharmaceutical Journal* commenced in 1875 with a paper on "The Asafœtidas of the Bombay Market," this was followed by others on "Ammoniacum and Dorema Root," "Myrrh" and "Chaulmoogra Oil." In 1876, the well-known "Notes on Indian Drugs" first appeared, and were a feature of the Journal for the next four years. Specimens of these drugs were at the same time liberally supplied to the Pharmaceutical Society's Museum, and were sent to pharmacologists in England and the Continent for chemical investigation. In 1883 he brought out his "Vegetable Materia Medica of Western India," and this was amplified into a second edition only two years afterwards. The publication of a more comprehensive work on Indian Materia Medica, based on the same plan, was conceived in 1888, and next year the first part of the "Pharmacographia Indica" was issued. The greater responsibility of this work rested with him, and to it he gave his whole time until his fatal illness compelled him to cease from his labours a few days before he died. The manuscript of the sixth part, as far as he could prepare it, was written, and he compiled an index and an appendix which will be printed as soon as possible.

Dr. Dymock was one of the founders of the Anthropological Society of Bombay, and most actively supported the Society in the successive positions of member of the Council, President (1889), and General and Literary Secretary. The subject of his Presidential address was, "India as a field for Anthropological Research," and among his papers read at the meetings were

"Anthropogonic Trees," "On the Narcotics and Spices of the East," "The Flowers of the Hindu Poets," On the use of Turmeric in Hindu Ceremonial" and "On the use of Ganja and Bhang in the East." He also read papers before the Bombay Natural History Society and the Medical and Physical Society. He was honorary member of the Pharmaceutical and other learned societies. In 1887 he was awarded the Hanbury Gold Medal for his researches in the natural history and chemistry of drugs.

As a scientific investigator Dr. Dymock was thorough and conscientious; in his literary researches he was careful and painstaking; his disposition was kind and obliging. Although a man of varied and great talents he was of very retiring habits, and had very few social acquaintances. His subordinates regarded him as a father, and his correspondents in different parts of the world could always count upon a punctual and friendly reply to their enquiries. He was the greatest pharmacognoscist in this country, and many besides ourselves will mourn that such a useful career was so suddenly terminated.

C. J. H. WARDEN.

DAVID HOOPER.

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OPINIONS OF THE PRESS.

PHARMACOGRAPHIA INDICA. BY W. DYMOCK, C. J. H. WARDEN, AND DAVID HOOPER. PART IV.*

THE undertaking of the authors, in the preface of the first volume, to supplement the previous work published by Dr. Dymock with original investigation concerning the chemical composition and physiological action of Indian drugs, and to give toxicological statistics relating to the more important drugs, has been most conscientiously carried out. Consequently the present part, which completes the second volume, does not extend further than *Nicotiana Tabacum*, and the two volumes already published contain, as nearly as possible, twice as much matter as can be found in the 'Materia Medica of Western India,' up to the same point. Yet there still remains enough matter to be treated of to fill at least one more volume. Several new alkaloids have been discovered during the chemical examination to which some of the hitherto unexamined articles of materia medica have been subjected. Of these some have received a name, but of others only sufficient has been obtained to indicate their presence. Of those which have received a name may be mentioned—Bahmanine from red behen root; Nyctanthine from *Nyctanthes arbor tristis*; Jasminine from *Jasminum grandiflorum*; Salvadorine from *Salvadora persica*; Tylophorine from *Tylophora asthmatica*; Dæmine from *Dæmia extensa*; and Cuscutine from a species of Cuscuta. A new glucoside, to which the name of Dregein has been given, has been discovered in *Dregea volubilis*, an asclepiadaceous plant, and another, viz., gymnemic acid, in *Gymnema sylvestre*, a plant belonging to the same natural order.

Toxicological statistics form a marked feature in the present volume, the recorded cases of poisoning by *Plumbago rosea*, *Nerium odorum*, nux vomica and stramonium are given in a tabulated form. The last two appear to be the poisons most commonly in use for criminal purposes in India, for the tables extend over twenty-seven pages in the case of nux vomica and thirty-two in that of stramonium. In some instances interesting information is contributed concerning plants that are common in this country, but of which the medicinal properties are almost unknown here. Thus *Anagallis arvensis* is said to be used in India as a fish poison and to kill leeches, and Orfila's statement to the effect that three drachms of an extract of the plant proved fatal to a dog, and M. Gronier's that the plant has a poisonous effect on hares is probably known to but few. *Sonchus oleraceus*, a common weed in this country, is mentioned as possessing active hydrogogue properties and being likely to be useful in ascites and hydrothorax. 'Pharmacographica Indica' thus forms a work, the usefulness of which is by no means confined to India. Being brought quite up to date, it will be found very valuable for purposes of reference on materia medica generally. Here and there throughout the volume interesting historical notes appear. In one of these, nepenthe is identified with henbane, Baron Hammer Purgstall's observation to this effect being quoted. "Bendj," the plural of which in Coptic is "nibendj," is without doubt the same plant as nepenthe, which has so much perplexed the commentators of Homer. Helen evidently brought the nepenthe from Egypt, and bendj is there still reputed to possess all the wonderful qualities which Homer attributes to it.

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* London: Kegan Paul, Trench, Trübner and Co. 1891. Demy 8vo. pp. 305-644.

'Pharmacographia Indica,' like its namesake, is a work of reference that no student of materia medica can afford to be without, and which is not only valuable for the accuracy of its statements, but so far as its historical matter concerns cannot fail to prove most interesting to the student of Eastern languages, almost as much so as to the student of materia medica. The articles on poisons also should prove of great value to medical jurists, more particularly in India. Even the indefatigable searcher for new remedies will probably find scope for his energies in the long list of articles of materia medica as yet untried in this country. One of the most promising of these seems to be *Cosmostigma racemosum*, the root-bark of which, in doses of five grains, has been found by the authors to be "a most efficient cholagogue, without purgative effect, but restoring the natural colour of the stools after the usual remedies, mineral acids, podophyllum, euonymin, etc., had been abandoned in despair." With these few extracts, the reader may be left to dive for himself into this treasure house of Eastern materia medica. (*Pharmaceutical Journal.* July 11th, 1891.)

Pharmacographia Indica; a History of tho Principal Drugs of Vegetable Origin met with in British India. William Dymock,

C. J. H. Warden, David Hooper, authors. Part IV, pages 305—642, with Index to second volume.

In noticing preceding numbers of this work which have come to hand we have remarked that these authors are doing work for the materia medica of India, which for completeness, value and interest entitled it to compare with the work done by Flückiger and Hanbury in their famous Pharmacographia.

In the present number we have in the pages before us an account of about 100 drugs, which represent the following orders: Compositæ, Campanulaceæ, Ericaceæ, Plumbagineæ, Primulaceæ, Myrsineæ, Sapotaceæ, Ebenaceæ, Styraceæ, Oleaceæ, Salvadoraceæ, Apocynaceæ, Asclepiadeæ, Loganiaceæ, Gentianaceæ, Boragineæ, Convolvulaceæ, Solanaceæ.

The excellence of the contributions will receive the acknowledgment of all botanists, and the reliability of the material is assured from the names of the authors, hence the work may be regarded as having all the information at present known of the respective drugs mentioned. The contributions to science by these gentlemen entitle them to warm praise. (*Pharm. Record.* July 30th, 1891.)

Pharmacographia Indica.—A History of the principal Drugs of Vegetable Origin met with in India. By Wm. Dymock, Brigade-Surgeon, retired, etc.; C. J. H. Warden, Surgeon-Major, Bengal Army, etc.; and D. Hooper, Quinologist, etc. London: Kegan Paul, Trench, Trübner & Co. 1891.

Part IV. of this work, now before us, completes its second volume, and besides several orders of minor importance treats of the drugs procured from the orders of Sapotaceæ, Styraceæ, Apocynaceæ, Asclepiadeæ, Loganiaceæ, Gentianaceæ, Convolvulaceæ, and Solanaceæ. This part is characterized by all the excellencies upon which we have commented in connection with the preceding parts on their publication. Among the plants a number are noticed which are either indigenous or spontaneous in North America, like chicory, taraxacum, Sonchus oleraceus, Anagallis arvensis, dulcamara, stramonium, etc.; while others are cultivated either for ornament or other purposes, like Tagetes erecta, calendula, jessamine, oleander, Ipomæa Bona-nox, capsicum, tobacco and others. Far more numerous are those plants which are either indigenous to India or have become naturalized there from other tropical countries. (*American Journ. of Pharmacy.* August, 1891.)

Part VI is in the Press and will be ready at Midsummer.

An appendix, together with a copious Index of more than 100 double-column pages, is under preparation, and will be published as soon as the work is completed.

5-7254.

PHARMACOGRAPHIA INDICA.

SCROPHULARINEÆ.

VERBASCUM THAPSUS, *Linn.*

Fig.—*Eng. Bot. viii., t.* 549; *Woodv. Med. Bot., t.* 125. Great Mullein (*Eng.*), Bouillon blanc, Molène (*Fr.*).

Hab.—Temperate Himalaya. Westwards to Britain. The root, leaves, and flowers.

Vernacular.—Phúlla, Ban-tambákú (*Hind.*).

History, Uses, &c.—The Hindi names for this plant are well chosen: Phúlla signifies "covered with flowers" and Ban-tambákú "wild tobacco." As far as we know it is not mentioned by Sanskrit medical writers. The Arabians describe it under the names of Adán-ed-dubb, "bear's-ear," and Mahizahraj, "fish poison"; it is also called Sikrán-el-hut, "fishes' hemlock," and in modern Arabic, Labidat-el-baida, "white felt plant," and Busir.

Mahizahreh and Busir are Persian names for Mullein, which is described very exactly by Haji Zein in the Ikhtiárát.

Mahometan physicians consider it to be hot and dry in the third degree, and prescribe it in gout and rheumatism in combination with aperients. They identify it with the φλόμος or φλομίς of the Greeks of which several kinds are described by Dioscorides as useful in diarrhœa and cough, and externally as an emollient; one kind, φλομίς λυχνιτις, was used for making lamp wicks. The narcotic action of Mullein on fish appears to be well known to the Arabs and Persians. According to Dr. Stewart, the roots are used in Northern India as a febrifuge.

In Europe Mullein has long had a reputation in the pulmonary diseases of cattle, on which account it bears the name of *Cow's Lungwort*. In Germany the plant is placed in granaries to drive away mice. The stalks covered with pitch were formerly used as flambeaux, from this practice the plant derived its names of *Cierge de Notre-Dame* and *Fleur de grand Chandelier* in France, and *High Taper* in England. The leaves and flowers are considered to be demulcent, diuretic, anodyne, and antispasmodic, and have long been in use in diarrhœa and pulmonary affections. An infusion of the flowers is used in France as a diuretic, and a cataplasm of the leaves as an emollient. The seeds are said to be narcotic, and to have been used in asthma and infantile convulsions. In 1883 Dr. F. J. B. Quinlan (*Brit. Med. Journ.*) drew attention to the popular use of the leaves boiled in milk as a remedy for phthisical cough and diarrhœa in Ireland, and stated that the plant was cultivated in gardens on rather an extensive scale. He claims for it weight-increasing and curative powers similar to those possessed by cod liver oil.

Description.—The root-leaves are from 6 to 18 inches in length, the cauline oblong, the upper ones being acuminate and sessile on the stem, more or less crenate, thickly covered with soft, whitish, stellate hairs. They have a mucilaginous somewhat bitter taste, and a disagreeable odour when fresh, which is lost on drying.

The flowers form a spike 6 to 10 inches in length, the corolla only is collected. It is from ½ to ¾ inch in diameter, bright yellow, 5-lobed, smooth above, and stellately tomentose beneath; attached to the tube are the stamens, of which the three upper are woolly, and the two lower longer and smooth. The taste is mucilaginous and somewhat bitter. The plant described by Haji Zein appears to be *V. Blattaria,* as he says that the flowers have a purple eye. The odour of the flowers has been compared with that of orris root.

The seeds are about $\frac{1}{25}$ of an inch in length, cone-shaped, finely pitted, very tough and difficult to powder, nearly inodorous, and have a somewhat acrid taste.

Chemical composition.—Morin (*Journ. Chim. Med. ii.*, p. 223) obtained from the flowers a yellow volatile oil, a fatty acid, free malic and phosphoric acids, malate and phosphate of lime, acetate of potash, uncrystallizable sugar, gum, chlorophyll, and a yellow resinous colouring matter.

Adolph Latin submitted the leaves to proximate analysis and found the constituents to be 0·80 per cent. of a crystalline wax, a trace of volatile oil, 0·78 per cent. of resin soluble in ether, 1·00 per cent. of resin insoluble in ether, but soluble in absolute alcohol, a small quantity of tannin, a bitter principle, sugar, mucilage, &c. The moisture in the air-dried sample amounted to 5·90 per cent., and the ash to 12·60 per cent. He concludes that the plant contains many of the usual constituents, and a bitter principle which may be prepared by exhausting the drug with alcohol, dissolving the alcoholic extract in water and agitating with ether or chloroform. Several trials failed to secure this substance in a crystalline condition. It was found to be soluble in water, ether, alcohol, and chloroform, and to possess a decidedly bitter taste. It responded to none of the tests for a glucoside or alkaloid. (*Am. Journ. Pharm.*, Feb. 1890. E. L. Janson (1890) found that petroleum ether and stronger ether used successively, extracted from the flowers about ½ per cent. in each case. A decided change in the colour of the drug was noticed after the extraction with ether, which removed the yellow colour, leaving the residue of a dark green. The yellow colouring matter was either a part of, or else it was retained by, the resin dissolved by ether, and it was not found possible to separate it in the pure state. The drug after exhaustion with ether yielded 10·06 per cent. to absolute alcohol. A considerable portion of this alcoholic extract was soluble in water acidified with hydrochloric acid. When agitated with petroleum ether the acid solution yielded some colour to it, and this latter solvent on evaporation left a greenish-brown crystalline mass of a strong disagreeable odour and a sweet taste, which proved to be an easily decomposable glucoside. Another crystalline extractive was obtained by making the above acid solution of the alcoholic extract alkaline and agitating with ether; while chloroform subsequently extracted a red-brown amorphous mass.

Both of these extractives reduced Fehling's solution, and many changes in colour were noticed, indicating that these substances take some part in the colouring matter of the flowers.

The drug was also found to contain 2·49 per cent. of mucilage, 11·76 per cent. of carbohydrate corresponding to dextrin, 5·48 per cent. of glucose, 1·29 per cent. of saccharose, 16·76 per cent. of moisture, 4·11 per cent. of ash, and 32·75 per cent. of cellulose and lignin. No reaction indicating tannin was obtained with iron salts, but an aqueous solution of the alcoholic extract yielded a slight precipitate with gelatin. The seeds yielded to petroleum ether 20·75 per cent. of a bright green fixed oil. The acrid principle was obtained from the alcoholic extract soluble in water by agitating with petroleum ether. The moisture was 10·86 per cent., and the ash 3·90 per cent. (*Amer. Journ. Pharm.*, Dec. 1890.)

Celsia coromandeliana, *Vahl.*, *Wight Ic.*, *t.* 1406, is an annual plant having the characters of Verbascum, which is common in many parts of India in the cold weather, usually appearing in fields or in the beds of rivers. It has much the same medicinal properties as *Verbascum Thapsus*, and has been brought to notice by Dr. B. M. Chatterjee as a sedative and astringent in diarrhœa. (*Phar. of Ind.*, p. 161.) The plant is slightly bitter and abounds in mucilage. The natives usually express the juice (*ang-ras*) and administer it in ounce-doses as a cooling medicine in fever, skin eruptions, dysentery, and such diseases as they consider to be due to heat of blood.

The plant is herbaceous, pubescent, and viscid; lower leaves lyrate, floral cordate, stem clasping; peduncles longer than the calyx; calycine segments ovate, slightly toothed, or oblong-lanceolate, entire; flowers largish, yellow; filaments bearded with purple hairs.

The Sanskrit name is Kuláhala; in Bengal it is known as Kukshima, and in the Deccan as Kutaki.

SCHWEINFURTHIA SPHÆROCARPA,

A. Braun.

Fig.—*Burm. Fl. Ind., t.* 39, *f.* 2; *Wight Ic., t.* 1459.

Hab.—Sind, Biluchistan, Afghanistan. The herb in fruit.

Vernacular.—Sannipát *(Ind. Bazars).*

History, Uses, &c.—In Hindu medical literature and in popular use, *San-nipáta* is a term which signifies a combined derangement of the three humors, Váta, Pitta, and Kafa (air, bile, and phlegm), which is supposed to produce *Sannipáta-jvara,* or fever with typhoid symptoms. The remedy for this condition is said to be a plant called Sannipáta-nud, "driving away sannipát," and Nepála-nimba, "Nepal Neem" or "Nepal bitter." At the present time the drug sold in the shops is *S. sphærocarpa,* but whether it is the original Nepal Neem is difficult to decide, as at present we do not even know whether this plant is found in Nepal. In typhoid conditions the drug is considered to act as a tonic, to promote diuresis, subdue fever, and remove the derangement of the humors. We are not aware of any experiments having been made with it by European physicians in India, though its near relationship with the Antirrhinums, which contain glucosides similar to those of Digitalis, would, we should have thought, have excited curiosity in regard to its physiological action.

Description.—The drug consists of the plant in fruit, broken up into small pieces. The fruit is a globular dry papery mucronate capsule, firmly attached to the calyx; the upper part of the capsule to which the placenta is attached is double; the placenta, which is large and oblong, is supported upon a thick peduncle, and occupies the centre of the capsule; to it are attached numerous straight 5-angled wedge-shaped seeds, which are packed closely together and fill the remaining space. The calyx is 5-partite, the upper segment very large and extending over the fruit like a hood. Leaves ovate, leathery, about 1 inch long with short blunt hairs; margin much lighter in colour than the rest of the leaf; seed straight, wedge-shaped, with six prominent longitudinal ridges; testa tubercular, each tubercle minutely granular. The portions of stem, which are numerous, are woody and covered by a thin grey bark; the central pith is very large. The drug has a slightly bitter somewhat tea-like taste.

Chemical composition.—The powdered drug treated with ether yielded a dark olive-green extract, consisting of chlorophyll and uncrystallizable fatty matter. Subsequent percolation with alcohol removed a deep brown extract, from which cubical crystals of alkaline chlorides separated on evaporation. An aqueous solution of this extract had a saltish taste and gave distinct precipitates with alkaloidal tests. The alkaloid was removed by ether in an amorphous condition, and gave no well-marked colour reactions with the strong mineral acids. By continuing the exhaustion of the powdered drug with water, a deep reddish brown extract was obtained having a bitterish and nauseous taste, and containing saccharine and other matters which readily fermented. In order to ascertain if the drug contained a substance similar to digitalin, a fresh decoction of the powder was filtered and precipitated by tannin, the precipitate washed, mixed with an excess of alkali, and shaken with ether. The result was the separation of an alkaloid similar to that previously found. As more recent investigators prepare digitalin by exhausting with alcohol after treatment of the drug with water, this process was adopted with *Schweinfurthia.* The resinous matter collected had an acrid taste, but no principle could be obtained possessing the properties of digitalin, digitonin or digitoxin, to which, according to Schmiedeberg, the poisonous qualities of digitalis are due. Besides the alkaloid, which we consider to be the active principle, the drug yielded 18·6 per cent. of mineral matter.

Lindenbergia urticæfolia, *Lehm., Hook. Ic. Pl., t.* 875, is a common plant throughout India upon walls and banks; the juice is given in the Concan in chronic bronchitis, and mixed with that of the Coriander plant is applied to skin eruptions. It has a faint aromatic odour and a slightly bitter taste. The

Marathi name in the neighbourhood of Bombay is *Dhol.* Roxburgh, under the name of *Stemodia ruderalis,* gives the following description of it :—" *Root* ramous, seems perennial. *Stems* many, ascending, ramous, herbaceous, woody, somewhat viscous, the whole plant about 12 or 18 inches high. *Leaves* opposite, petioled, ovate, deeply serrate, soft, a little hairy; about an inch long. *Petioles* shorter than the leaves, channelled. *Stipules* none. *Flowers* axillary, subsessile, solitary, opposite, small, yellow. *Calyx* 10-furrowed, 5-toothed, permanent. *Corol* personate; *tube* the length of the calyx; both lips projecting, and shut; apex of the under lip broad, depending, 3-toothed, of the upper one very narrow, bifid; inside of both hairy, and beautifully marked with small purple dots. *Filaments* and *anthers* as in the genus. *Stigma* slightly 2-lobed." (*Flora Indica,* III., 94.)

LIMNOPHILA GRATIOLOIDES, *Br.*

Fig.—*Rheede, Hort. Mal. ix., t.* 85, *and xii., t.* 36.

Hab.—Throughout India, in swamps. The plant.

Vernacular.—Kuttra (*Hind.*), Karpur (*Beng.*), Ambuli (*Mar.*), Mánga-nári (*Mal.*).

History, Uses, &c.—This small aquatic plant, in Sanskrit Ambu-ja, "water born," and Ámra-gandhaka, having an odour of mangoes," is considered to be antiseptic by the Hindus, and its juice is rubbed over the body in pestilent fevers. Rheede notices its use for this purpose, and also internally in dysentery combined with ginger, cumin, and other aromatics. He also states that a liniment is made from the plant with cocoanut oil which is used in elephantiasis. Roxburgh, under the name of *Columnea balsamea,* describes the plant and notices its grateful odour and aromatic taste. The Bengal name signifies "camphor." The odour of the fresh plant is remarkably refreshing and agreeable and calls to mind that of camphor and oil of lemons.

L. gratissima, *Rheede, Hort. Mal. x.,* 6, has similar properties and bears the same vernacular names; it is also used medicinally as a cooling medicine in fever, and given to women who are nursing when the milk is sour.

Description.—In its most common form a simple or branched plant 4—8 in. high, with whorled pinnatifid leaves ¼—¾ in. long, which, in wetter places, appears to acquire a few emersed, opposite, entire leaves at the top of the stem, and numerous capillaceo-multifid ones at its base. The stems are stout or slender. Very small specimens from Rohilkund (Kuttra, Edgeworth) have very wiry simple stems 3 in. high, and capillary peduncles three times as long as the leaves; others have stout stems and peduncles, the latter shorter than the leaves. Calyx ⅛—⅙ in. long, rarely larger. Corolla ⅓ in., blue. (*Fl. Br. Ind.*)

HERPESTIS MONNIERA, *H. B. et K.*

Fig.—*Bot. Mag., t.* 2557; *Roxb. Cor. Pl. ii., t.* 178; *Rheede, Hort. Mal. x., t.* 14. Gratiole de l'Inde (*Fr.*).

Hab.—Throughout India, in marshy ground. The herb.

Vernacular.—Sufed-chamni, Barambhi (*Hind.*), Dhop-chamni, Brihmi-sák (*Beng.*), Nir-brami, Bámba (*Mar.*), Nir-brami (*Tam.*), Sámbráni-aku, Sámbráni-chettu (*Tel.*).

History, Uses, &c.—Dutt states that this plant is the Brahmi of the native physicians of Calcutta, where it is considered to be a nervine tonic useful in insanity, epilepsy, fever, &c. It is certainly not the Brahmi of the Nighantas, but would appear to be the plant called Jala-brahmi or "Water Brahmi" by Sanskrit writers. Owing to a similarity in the names it has frequently been confounded with *Hydrocotyle asiatica,* which is the Brahmi or Brahmi-manduka of the Nighantas.

Ainslie says that in Southern India the *Gratiola Monniera* is considered diuretic and aperient, and useful in that sort of stoppage of urine which is accompanied with obstinate costiveness. Roxburgh mentions the use of the juice mixed with petroleum as an external remedy in rheumatism. These accounts do not agree with the properties ascribed to Brahmi by Sanskrit writers. Rheede says of it:—"Ex frequenti hujus plantæ usu, vaccarum ubera lacte turgent; sit et decoctum ex illa in lacte vaccino et recenti butyro, contra delirium temporibus inunguendum; Pipere, Calamo aromatico, Myrobalanis et aqua oryzæ trita et assumpta, vocem reddit sonoram." In Pondicherry it is considered to be aphrodisiac, and in Ceylon, under the name of *Loonoo-weela*, it is prescribed in fevers.

Description.—Stems several, annual, creeping, round, jointed, smooth, succulent; leaves opposite, sessile, obovate, wedge-shaped, or oblong, smooth, entire, obtuse, fleshy, dotted with minute spots; peduncles axillary, alternate, solitary, round, smooth, shorter than the leaves, one-flowered; flowers blue; bracts 2-awled, pressing on the calyx laterally; calyx 5-leaved, the exterior three leaflets large, oblong, the two interior small, linear, all are concave, smooth, pointed and permanent, corol campanulate, border 5-partite, nearly equal; anthers 2-cleft at the base, blue; stigma large, somewhat 2-lobed; capsule ovate, 2-celled, 2-valved; seeds very numerous. (*Roxb.*, *Flora Ind.*, I., p. 141.)

Chemical composition.—For the analysis the whole plant was used, dried at a low temperature and exhausted with 80 per cent. alcohol. The alcohol freed extractive was then agitated with petroleum ether; ether from an acid solution, and again with ether from an alkaline solution, and finally with chloroform from an alkaline solution. Operating in this manner, a trace of oily matter was obtained, soluble in alcohol with acid reaction; two resins, one easily soluble in ether, the other soluble with difficulty, but both soluble in alkaline solutions and reprecipitated by acids; an organic acid, and a tannin affording a green coloration with ferric chloride. An alkaloidal principal was also isolated, soluble in ether and in chloroform, and affording a cherry red coloration in the cold with Fröhde's reagent. No other reactions were noted.

PICRORHIZA KURROOA, *Benth.*

Fig.—*Royle Ill.*, *t.* 71.

Hab.—Alpine Himalaya; from Cashmere to Sikkim. The root.

Vernacular.—Katki, Kutki (*Hind.*, *Beng.*), Katuku-rogani (*Tam.*), Katuku-roni (*Tel.*), Bâl-kadu (*Mar.*), Kutaki (*Guz.*).

History, Uses, &c.—This well-known drug is the Kutaki of Sanskrit writers, who speak of it as Dhanvantari-grastá, "the plant eaten by Dhanvantari," the physician of the gods, who was produced at the churning of the Ocean, holding a cup of *amrita* in his hands; he was the author of the Ayurveda. In the Nighantas it bears the following synonyms: Rohini, Katu-rohini, Vakrágra, Matsya-pitta, Matsya-vinna, Kánda-ruha, Krishna-bhedi, Dvijángika, Asoka-rohini, Sákuládani and Chakránga. It is described as digestive, bitter, pungent, dry, aperient, light and cold; and is recommended as a remedy for worms, asthma, bile, phlegm, and fever. Kutaki is a favorite remedy in bilious dyspepsia accompanied by fever, and is given daily in decoction, with liquorice, raisins, and Neem bark, half a tola (90 grains) of each, water 32 tolas, boiled down to one-fourth. In dyspepsia and dysentery it is combined with aromatics and is given in doses of ten to twenty grains.

It is considered to be specially indicated in those cases in which the secretions are scanty and the bowels costive, and is often prescribed for children suffering from worms, whence the Marathi name Bálakadu, "children's bitter."

Chakradatta states that about two drachms of the powdered root given with sugar and warm water act as a gentle aperient. Mahometan writers give Katki or Kutki as an Indian synonym for black Hellebore, and unmistakably describe the latter plant and its medicinal properties. This mistake has misled most European writers upon Indian drugs, but Ainslie, though he describes the drug in his article upon black Hellebore

(*Mat. Ind.*, I., p. 164), has the following remarks:—"I have given the names *Kadagoroganie* and *Kali-kootkie* as the Tamool and Dukhanie appellations of the black Hellebore, as the root procured in the Indian bazars is commonly said to be so; but I have great doubts of it, and I here offer a caution respecting it, as it by no means agrees in appearance with the black Hellebore of the European shops."

Royle (*Ill. i.*, p. 291) notices that the root of *P. Kurrooa* possesses much bitterness and is employed medicinally by the natives. Irvine (*Mat. Med.*, p. 58) mentions the use of Kutki as a tonic, but owing to a general impression that the bazar drug was Hellebore root, European medical men appear to have generally avoided making experiments with it. Mr. Moodin Sheriff was the first modern writer to clearly demonstrate that the bazar drug has no dangerous properties, but is a valuable tonic and antiperiodic. He also identified it with the *P. Kurrooa* of Royle, an identification which we are now able to confirm through the kindness of Mr. J. F. Duthie who has supplied us with a specimen of the plant collected in Kumaon. As regards the medicinal properties of the drug, the accounts given by Sanskrit writers appear to be correct. Mr. M. Sheriff speaks favourably of it as a powerful bitter tonic and antiperiodic. Other medical men in India have expressed a similar opinion, and we can state from personal observation that it is used successfully as an antiperiodic in native practice; its slight laxative action is rather beneficial than otherwise. The dose as a tonic is from 10 to 20 grains, as an antiperiodic from 40 to 50 grains; it is best administered in combination with aromatics.

Description.—The drug consists of a rhizome, generally about the size of a goose-quill, but often no larger than a crow-quill, the lower portion of which is covered by a shrivelled, greyish-brown, corky bark, and marked by prominent scars, the remains of rootlets; towards the upper end it becomes larger (¼ inch in diameter), and is thickly set with dark greyish-brown scales, and terminates in a scaly leaf-bud or stem. The rhizome is generally broken into short pieces, from 1 to 2 inches long; the fracture is short, the root very fragile and light, and black internally; it has no odour, and a very bitter taste.

Microscopic structure.—The corky bark is made up of numerous rows of empty brick-shaped cells; within this is a cellular parenchyma of oblong brown cells, containing a little granular matter; next a dark brown line composed of wood cells, forming the boundary of the inner column of the root; within this several very large bundles of dotted vessels arranged so as to form a broken ring, which surrounds a central cellular parenchyma.

Chemical composition.—A proximate analysis of this drug showed the following percentage composition:—

Wax	1·06
Bitter principle (Picrorhizin)	14·96
Picrorhizetin	3·85
Organic acid ppt. by lead	3·54
Glucose	11·53
Cathartic acid, &c. (water extract)	9·33
Substances dissolved by NaHO	7·62
Arabin bodies from crude fibre	14·56
Fibre	24·00
Moisture	5·73
Ash	3·82

The bitter principle is a glucoside *Picrorhizin*, freely soluble in water and alcohol, but almost insoluble in pure ether. It is acid in reaction, is not precipitated from solution by lead salts or tannin, but is absorbed by animal charcoal together with any colouring matter that is present. It is best obtained by exhausting the powdered drug with crude ether, and is left, after the evaporation of the ether, in brown resinoid drops which form ramified crystals on standing. It is difficult to obtain the picrorhizin in a crystalline condition after heating or after solution in water. Any wax removed by the crude ether can be separated from the dry extract by petroleum spirit, which has no solvent action on the bitter principle. The picrorhizin is decomposed by hydrolizing it with a boiling 1 per cent. solution of hydrochloric acid for three hours, and a decomposition product, which we have named *Picrorhizetin*, is formed together with glucose. In obtaining 0·7 gram of picrorhizetin ·368 gram separated during the first hour, ·219 gram in the second hour, ·113 gram in the third hour, and none in the fourth. Weighed quantities of the picrorhizin, after drying at 100°C., afforded, on hydrolysis, 62·48 and 62·79 per cent. of picrorhizetin, as the result of two experiments. The glucose obtained from the decomposition was inactive towards polarized light. An infusion or tincture of the root boiled with diluted acid gradually loses its bitterness, and a large increase in the sugar is detected by Fehling's solution. Picrorhizetin is a red-brown, brittle, resinous, tasteless body soluble in aqueous alkalies. It is insoluble in water, and its solution in alcohol is precipitated by ether. By heating with strong sulphuric acid or when being burnt it evolves an odour of benzoin.

The wax after bleaching, and purifying by recrystallization from hot alcohol, had a melting point of 51°C. The organic acid separated by lead was red-coloured and gave a greenish colour with ferric salts. No tannic acid was present. Some picrorhizetin was naturally formed in the drug, and existed in a much smaller proportion in the freshly dried rhizome. After removing the bitter principle by continued percolation with alcohol, the marc was dried and exhausted with water, the dark red-brown solution was evaporated to dryness, and ·2 gram of the residue was found to act as a decided purge. The aqueous extract treated with four volumes of alcohol afforded precipitates containing 14·5 and 15·3 per cent. of mineral matter, and with six volumes a precipitate was obtained with 10·8 per cent. of ash. We rely upon the physiological action of this extract in considering cathartic acid to be a constituent.

Commerce.—Value, Rs. 9 per maund of 37½ lbs. Kumaon annually exports about five tons of this drug.

Plants of minor importance belonging to this order, which have a certain amount of medicinal reputation, are:—

Torenia asiatica, *Linn., Rheede, Hort. Mal. ix., t.* 53, the juice of which is given on the Malabar Coast for gonorrhœa.

Vandellia erecta, *Benth., Rheede, Hort. Mal. ix., t.* 57, called *Vaka-pushpi,* or "crane flower," in Marathi, is also used in a ghrita as a remedy for gonorrhœa, and the juice is given to children who pass green-coloured stools. **V. pedunculata,** *Benth. Griff. Ic. Pl. As., t.* 418, *f.* 2, in Marathi *Gadagvel,* is considered to have similar properties.

Veronica Beccabunga, *Linn. Reichb. Ic. Fl. Germ., t.* 1701, is used in Northern India under the name of *Tezak,* "cress," as a diuretic and antiscorbutic. It is the Bachbunge of the Germans, Cressonée of the French, and Brooklime of the English. **V. Anagallis,** *Linn. Reichb. Ic. Fl. Germ., t.* 1762, which has similar properties, takes its place in other parts of India.

Sopubia delphinifolia, *G. Don, Roxb. Cor. Pl. i., t.* 90, is an elegant annual, common in wet fields in the rainy season. The juice is applied by field labourers to their feet to heal sores caused by exposure to wet; it is astringent and stains the skin yellow at first but afterwards black. The plant was formerly named *Gerardia,* after John Gerarde, our old English botanist, and author of the "Herbal," published in 1597.

Pedicularis pectinata, *Wall.,* and several other species are used in Northern India under the name of *Mishran* on account of their astringent and hæmostatic properties.

BIGNONIACEÆ.

OROXYLUM INDICUM, *Vent.*

Fig.—*Wight Ic., t.* 1337; *Bureau Monogr. Bign., t.* 9; *Rheede, Hort. Mal. i., t.* 43.

Hab.—Throughout India. The root-bark.

Vernacular.—Arlu, Phalphala, Sona (*Hind.*), Nasona, Sona (*Beng.*), Mulin, Tálpalang, Miringa (*Punj.*), Tetu, Jagdala (*Mar.*), Tetu (*Guz.*), Vanga adanthay (*Tam.*), Tigdu-mara, Sonepatta (*Can.*), Pamania, Dundillam (*Tel.*), Peiani (*Mal.*).

History, Uses, &c.—This is a small tree, remarkable for its terminal spikes of large fleshy lurid flowers, which appear at the commencement of the rainy season, and are followed by very large, retrofracted, transversely compressed, somewhat curved pods, with the convexity upwards. The seeds are numerous, membranaceous, surrounded with a large, delicate, membranaceous wing. The leaves are supra-decompound, and from four to six feet long. The root-bark is of considerable importance in Hindu medicine, as it is an ingredient of the Dasamula (see *Tribulus terrestris*); it is considered to be astringent, tonic, and useful in diarrhœa and dysentery. Sarangadhara recommends the juice of Syonaka expressed from the roasted bark in combination with Mocharas (see *Bombax malabaricum*) as a remedy in diarrhœa and dysentery. He also says that the root-bark boiled in Sesamum oil is a good application in otorrhœa. In the Nighantas the tree bears many synonyms, amongst which may be mentioned Prathu-simbih, "having broad pods," Súka-nasa, "having a nose like a parrot's beak," in allusion to the flower buds, Aralu, and Bhalluka-priya, "dear to bears." It is described as digestive, appetising, bitter, astringent, cold, pungent; a remedy for wind, phlegm, bile, and cough. The bark is much used by the agricultural classes as an application to the sore-backs of draught cattle. It is ground to a paste with water and an equal proportion of turmeric, and rubbed on the part. Rheede notices the use of the bark as an application to wounds, fractures, &c., and of the root in decoction in dropsy.

Dr. B. Evers states that the Gonds call the tree *Jaimangal,* and that they employ a decoction of the bark as a discutient application to rheumatic swellings. He says:—"I have made a trial of the powder and an infusion of the bark, and have found it to be most powerfully diaphoretic; the drug has slight anodyne properties; also a bath, prepared with the bark, I have frequently employed in rheumatism. Twenty-eight cases of acute rheumatism were treated with this drug, and in all the results have been most satisfactory. The dose of the powder is from 5 to 15 grains, thrice daily; of the infusion (1 ounce of bark to 10 ounces of boiling water) an ounce three times a day. Combined with opium it forms a much more powerful sudorific than the compound powder of ipecacuanha. The drug does not possess any febrifuge properties."—*Indian Medical Gazette,* February and March, 1875.

Description.—The bark of the root is brown externally, yellow internally, thick, breaking with a short fracture. That of the stem is soft and spongy externally, and of a pale brown colour, furrowed longitudinally; the internal surface is fibrous and greenish yellow. The minute structure does not call for remark, but upon placing a section of the fresh bark under the microscope in a little water the whole field is seen to be filled with delicate needle-shaped crystals which have escaped from the cut cells of the parenchyma; in entire cells the crystals, which are of an inorganic nature, can be seen *in situ.* The bark is faintly bitter and a little acrid; it has no particular odour.

Chemical composition.—The bark has been examined by W. A. H. Naylor and E. M. Chaplin with the following results:—

A. One pound of the bark reduced to fine powder was percolated to exhaustion with cold petroleum ether. The ether was distilled off, and the residue, which weighed about 1·8 gram, possessed the characters of a soft greenish-brown fat, having an acid reaction and a slightly acrid taste. It was treated successively with ether and proof spirit; the former removed vegetable wax, which was subsequently identified as such after re-solution in limited quantities of ether and separation therefrom. The latter on evaporation gave a brownish-yellow residue small in quantity and crystalline. When further purified by extraction with ether and the ethereal residue by benzol it was golden yellow, unctuous to the touch, and pronouncedly acrid. Under the microscope it presented the appearance of long, wavy, branching crystals, which dissolved readily in alcohol, chloroform ether, petroleum ether, and benzol.

B. The marc was next percolated with cold ether. After distilling off the greater portion of the ether, and allowing the remainder to evaporate spontaneously, a yellow mass studded with minute interlacing crystals was obtained, which when air-dried weighed about 4 grams. This product was treated with boiling proof spirit and filtered while hot; on cooling small yellow crystals fell out of solution. When quite cold the crop of crystals was collected and subjected to the action of boiling petroleum ether until freed from every trace of fat. It was then cystallized from boiling proof spirit until it had a constant melting point, and was no longer contaminated with uncrystallizable matter. The resulting crystals were dried under the receiver of an air-pump, and when constant weighed 0·9 gram. They were of a lemon yellow colour, about ⅛ inch in length, and melted at 228·5°—229° C. Alcohol, ether, glacial acetic acid, and hot benzol dissolved them readily, but they were practically insoluble in water hot or cold. The following reactions in connection with this interesting body have been noted, of which the most striking is its behaviour with the caustic alkalies. A minute quantity brought into contact with one drop of a weak solution of sodium potassium or ammonium hydrates causes it to assume immediately a cherry-red colour, which quickly passes into brick-red and olive-green.

Owing to the insolubility of the crystals in water a proof spirit solution was used in applying the following tests:—

1. A solution of silver nitrate in proof spirit produced a bluish-black colour immediately, and after the liquid had stood

for a few minutes black particles of reduced silver were precipitated.

2. A solution of neutral acetate of lead in proof spirit gave a light-red bulky precipitate insoluble in boiling acetic acid.

3. Lime water imparted an orange colour, which quickly changed to olive-green, followed by a precipitate of the same colour.

4. An aqueous solution of sulphate of copper gave a golden yellow colour, quickly followed by a dirty brown precipitate, the supernatant liquid being distinctly greenish.

5. Solution of ferric chloride (acid) produced a brownish-red colour, which, in a few minutes, turned smoke-colour.

6. Solution of subacetate of lead gave a golden yellow precipitate.

7. An aqueous solution of mercuric chloride produced a white precipitate.

8. An aqueous solution of permanganate of potash, acidified with sulphuric acid, was *instantly* decolorized.

9. A solution of the crystals in proof spirit did not reduce Fehling.

The authors say:—"We have attempted to hydrolyse this body, by subjecting a strong alcoholic solution to the prolonged action of 10 per cent. solution of sulphuric acid at a boiling temperature, but without success.

"We have also inquired into its nature and centesimal composition, but the results so far obtained are not sufficiently conclusive to be incorporated in this paper. We hope to be able to publish shortly a supplementary note dealing with points in process of investigation. Meanwhile, we propose that this interesting principle be designated *Oroxylin.*"

C. The marc left after exhaustion with petroleum spirit and ether was percolated with cold absolute alcohol. The residue resulting from the distillation of the spirit was treated with cold proof spirit, which took up the greater part of it. The insoluble portion dissolved readily in boiling proof spirit, and, on examination, proved to be largely composed of the yellow crystalline body oroxylin. The cold proof spirit solution of the alcoholic residue was evaporated to dryness and the extract treated with water and filtered. The filtrate was treated successively with neutral and basic acetate of lead, and the precipitates after washing were suspended in water, decomposed by a current of sulphuretted hydrogen and the resultant plumbic sulphide removed by filtration. Sulphuretted hydrogen was also passed through the filtrate from the basic or plumbic acetate and the precipitated lead sulphide removed by filtration.

The three liquids thus obtained, which for convenience may be denominated i., ii., iii., were then evaporated down and the respective residues examined.

(i.) It was dissolved in the smallest quantity possible of cold water and diluted with many times its volume of alcohol. After setting aside for twenty-four hours a precipitate fell, giving the general characters of parapectin. The supernatant liquid on evaporation left a scaly residue, astringent to the taste, and perfectly soluble in water. Its aqueous solution reduced Fehling and gave a copious bluish black precipitate with ferric chloride. Lime-water produced a bright golden-yellow colour, followed by a reddish-brown precipitate. From the tannins proper it differed in that it was not precipitated by solution of gelatine.

(ii.) This residue apparently consisted of pectin intermixed with small portions of No. iii.

(iii.) This was a dark uncrystallizable treacly-looking residue, which imparted to the palate a feeble sensation of sweetness. It was very soluble in water and reduced Fehling's solution abundantly. A strong aqueous solution was precipitated by absolute alcohol.

D. The marc from the alcoholic extraction was finally percolated to exhaustion with cold water. The liquor was evaporated down and the extract obtained taken up with hot water. A considerable amount of albuminous matter, which remained insoluble, was removed by filtration. The filtrate was treated successively with neutral and subacetate of lead and the precipitates decomposed in the same manner as described under C. The three liquids obtained, i., ii., iii., were evaporated down.

(i.) This residue was the smallest of the three. After standing for a considerable time some crystals were deposited, which on examination proved to be citric acid.

(ii.) Nothing of a crystalline nature was found in this residue. It appeared to consist chiefly of extractive matter.

(iii.) This residue after treatment with alcohol had the same characters and possessed the same properties as C. iii. It was not further examined.

The result of our examination of this bark may be summarized by stating the different principles which we have found—(1) crystalline fat; (2) wax; (3) acrid principle; (4) oroxylin; (5) chlorophyll; (6) pectinous substances; (7) Fehling-reducing principle; (8) astringent principle; (9) citric acid; (10) extractive matter.—*Pharm. Journ.*, Sept. 27, 1890.

STEREOSPERMUM SUAVEOLENS, *DC.*

Fig.—*Wight Ic., t.* 1342.

Hab.—Throughout the moister parts of India. The root-bark and flowers.

Vernacular.—Pád, Paral, Káshta-pátali (*Hind.*), Parul (*Beng.*), Kálgori, Pádri (*Mar.*), Pádri (*Tam.*), Kálgoru, Pádari (*Tel.*), Húdai, Pádri-gida (*Can.*), Pádri, Pandan (*Guz.*). The flowers, Madana-kama-pu (*South India*).

History, Uses, &c.—This tree is the Pátalá or Pátali of Sanskrit writers, the flowers of which are said by the poets to so intoxicate the bee that he is unable to distinguish one flower from another. The tree is sacred to Durga, the wife of Siva. In the Nighantas it bears among other synonyms those of Káma-duti "Cupid's messenger," Madhu-duti "messenger of spring," Stháli, Ambu-vásini, and Tamra-pushpa "red flowered." Pátala also signifies "light red" or "rose-coloured." It is described as cooling, sweet, diuretic, and tonic, and is recommended in dyspepsia, dropsy, cough, and heat of blood.

P. S. Mootoosawmy says that in Tanjore the flowers are taken in the form of a confection as an aphrodisiac. The flowers pounded with honey are said to stop troublesome hiccough, and the ashes of the bark are used in preparing alkaline ley and caustic pastes. The bark is in use throughout India from its being one of the ingredients in the Dasamula or "ten barks." (See *Tribulus terrestris.*) In parts of India where this tree is not found, various substitutes are allowed to be used. In Malabar and in the Concan *S. chelonoides*, DC., is used as Pádri. (See *Rheede, Hort. Mal. vi., t.* 25 ; *Ainslie, Mat. Ind. ii.*, p. 272.)

Description.—Trunk tolerably erect, though not straight. Bark ash-coloured, and somewhat scabrous. Leaves opposite, pinnate, with an odd one, from 12 to 24 inches long. Leaflets opposite, from two to four pairs, oval, with long bluntish, narrow points slightly serrate, having both sides downy while young, and when full grown not downy and feeling harsh ; the exterior pair and odd one about six inches long, by three or four broad; the inferior pair, or pairs, smaller. Petioles swelled at the base, roundish, when old scabrous. Panicles terminal, composed of a few spreading branchlets; the first and second pairs thereof opposite; the superior dichotomous, with a solitary pedicelled flower in the forks; all are downy, and somewhat viscid. Flowers large, of a dark, dull crimson colour, exquisitely fragrant. Calyx campanulate. Border 4-cleft; upper divisions with two minute points, outside a little villous. Corol, throat ample, woolly, convex above, flat and plaited beneath. Border, the upper divisions shorter, erect; the three inferior ones longer and projecting, with the margins of all much curled. Filaments 4, fertile, and between them a small sterile one. Anthers twin. Germ oblong, elevated on a glandular receptacle. Stigma 2-lobed. (*Roxburgh.*) Sir W. Jones gives the following description of the flowers:—Corolla externally light purple above, brownish purple below, hairy at its convexity ; internally dark yellow below, amethystine above, exquisitely fragrant; preferred by bees to all other flowers, and compared by the poets to the quiver of Kamadeva (the Indian Cupid).

Chemical composition.—An infusion of the dried flowers contained saccharine, mucilaginous and albuminous matters, but no alkaloid could be detected in either the aqueous or alcoholic extract. Ether removed a small quantity of a wax-like solid from the powdered corollas.

STEREOSPERMUM CHELONOIDES, *DC.*

Fig.—*Wight Ic., t.* 1341; *Bedd. Fl. Sylv., t.* 72; *Rheede, Hort. Mal. vi.*, 26. Favas da Cobre (*Port.*), Adderbonen (*Dutch*).

Hab.—Throughout the moister parts of India. The flowers, leaves, and root.

Vernacular.—Páder, Pádri (*Hind.*), Dharmara (*Beng.*), Pádal (*Mar.*), Pádri (*Tam., Mal.*), Tagada (*Tel.*), Padrigida (*Can.*).

History, Uses, &c.—In the Concan and Malabar, where *S. suaveolens* is not found, this tree is used as the Pátalá of the Nighantas. Rheede says of it:—"Viscerum rigorem intolerabilem dispellit foliorum decoctum. Limonis hujusque commixti succi medentur maniæ. Corticis vero succus, cum fructu Peræ subactus, immodicum inhibet fluxum menstruum. Radicis cutis cum Calamo aromatico, zinzibere contrita, foliorumque Padri succo admixta exhibetur morsis à putrefaciente colubro, Malabaribus *Polenga* dicto." Ainslie (ii., 272) says:—"This pleasant tasted root, as well as the fragrant flowers of the tree, the Vytians prescribe in infusion as a cooling drink in fevers."

The tender fruit and flowers of *S. chelonoides* are used as vegetables by the natives of Western India.

Description.—Trunk straight, of a great height and thickness. Bark thick, scabrous, brown. Branches very numerous, the inferior horizontal above, gradually becoming more and more erect to the top; leaves opposite, pinnate, with an odd one, about twenty inches long; leaflets opposite, short petioled, generally four pair, the inferior smallest, obliquely oval, pointed, sometimes slightly notched about the margins, when young downy, afterwards smooth, about 4 inches long by two broad; petioles about 9 inches long, channelled, smooth; stipules none; panicles terminal, the larger ramifications decussate, the smaller or terminal 2-forked, with a sessile flower in the cleft; peduncles and pedicels round, covered with oblong grey scabrous specks; bracts small, caducous; flowers pretty large, yellow, very fragrant; calyx 5-notched; nectary, a yellow fleshy ring surrounding the base of the germ; filaments, there is a fifth sterile one between the lower pair; anthers double; stigma 2-cleft; silique very long, slender, twisted; receptacle of the seeds spongy, white, with alternate notches on the sides for the seeds to lodge in. (*Roxb., Fl. Ind.*, III., 106.)

STEREOSPERMUM XYLOCARPUM, *Wight.*

Fig.—*Wight Ic., t.* 1335-6; *Bedd. Fl. Sylv., t.* 70.

Hab.—Deccan Peninsula. The wood and tar.

Vernacular.—Kharsing (*Mar.*), Ghansing (*Can.*).

History, Uses, &c.—This tree is a native of the forests of Western India from Khandesh to Malabar. It was introduced by Dr. Andrew Berry into the Botanic Garden at Calcutta, and is minutely described by Roxburgh.

The natives by a rough process of the same nature as that by which tar is obtained from Pine wood, extract from the wood a thick fluid of the colour and consistence of Stockholm tar, which they use as a remedy for scaly eruptions on the skin. Two globular earthen pots are used, the upper contains the wood in small pieces; it has a perforated bottom and is fitted with a cover, and is luted to the mouth of the lower pot. Cowdung cakes are then piled up round the two pots and set fire to. Dr. Gibson appears to have been the first to draw attention to the use of this substance by the natives. From some trials which we have made with it, we conclude that its properties are similar to those of Pine tar.

Description.—The wood is hard, but easily split; when sawn across it presents a yellow resinous surface; sections examined with the microscope show that the yellow colour is due to a solid resinous deposit in the pitted vascular system. The tar has exactly the odour, colour, and consistence of Stockholm tar.

Heterophragma Roxburghii, *DC., Roxb. Cor. Pl. ii., t.* 145, yields a similar product. Its vernacular names are Waras (*Mar.*), Baro-kala-goru (*Tam.*), Bondagu (*Tel.*).

Dolichandrone Rheedii, *Seem.*, is the *Nir-pongelion* of Rheede (vi., 29), who states that the seeds with ginger and Pavetta root are administered in spasmodic affections, and that in Malabar a decoction of the bark is used for preserving fishing nets. He gives *Cornos das Diabos* as the Portuguese name and *Bocks hoorn* as the Dutch.

Dolichandrone falcata, *Seem. Bedd. Fl. Sylv., t.* 71, a native of Oudh, Rajputana, Central and South India, has the reputation of being used to procure abortion, and the bark is, it is stated, used as a fish poison.

Dr. Lyon, Chemical Analyser to the Government of Bombay, found, however, no ill effects to follow the administration of a considerable quantity of a decoction of the bark to a small dog. (*Med. Juris. for India*, p. 216.) It is possible that the woody capsules, which are about a foot in length by ⅔ of an inch in diameter, and somewhat curved, may be used as abortion sticks.

CRESCENTIA CUJETE, *Linn.*

Fig.—*Jacq. Amb., t.* 111; *Plumb. Gen., t.* 109. Calabash tree (*Eng.*), Calebassier (*Fr.*).

Hab.—South America. Cultivated in India. The fruit.

Vernacular.—Kalabash (*Africa*).

History, Uses, &c.—The Calabash tree introduced from South America is now pretty well known in India, and latterly we have observed the fruit being offered for sale by the herbalists for use as a pectoral in the form of a poultice of the pulp applied to the chest. In the West Indies a syrup is made from the pulp, which is much used in dysentery and as a pectoral. The tree has oblong cuneate, often obovate, entire, shining leaves, and flowers variegated with green, purple, red and yellow. The fruit is large, gourd-like and green; it varies much in size, being from 2 inches to a foot in diameter.

Dr. Peckolt, of Rio Janeiro, states that an alcoholic extract of the not quite ripe fruit in doses of 0·10 gram. acts as a mild aperient, and that 0·5 gram. proves strongly drastic, without griping or ill effects. As an application against erysipelas, the fresh pulp is boiled with water until it forms a black paste, to which vinegar is added and the whole boiled together and spread upon linen.

Corre and Lejanne state that in Western Africa the leaves, along with those of *Adansonia digitata*, are boiled and eaten, and the seeds are eaten roasted. The pulp of the fruit macerated in water is considered to be depurative, cooling, and febrifuge; it is applied to the head in headache caused by insolation and to burns: roasted in ashes it is mildly purgative and diuretic, according to P. Labat; in the Antilles, Chevalier has recommended it in dropsies.

Description.—Fruit ovoid or nearly round, with a hard, green, woody shell; very variable in size. It is filled with a white, slightly acid pulp, in which are contained the flattened, somewhat cordiform seeds.

Chemical composition.—A chemical examination of the fresh fruit pulp yielded a new organic acid, crystallizing in plates, to which the name '*crescentic acid*' has been given. It was obtained by exhausting with water an alcoholic extract of the pulp, treating the aqueous solution with lead acetate, suspending the lead precipitate in water and decomposing and removing the lead, then evaporating to a syrupy consistence and leaving it to crystallize in a cool place. Besides crescentic acid, there were found tartaric, citric and tannic acids, two resins, a bitter and an aromatic extractive substance, and a colouring matter that appeared to resemble indigo. (*Peckolt, Pharm. Rundschau*, Aug. 1884; *Year Book of Pharm.*, 1885, p. 168.)

PEDALINEÆ.

SESAMUM INDICUM, *DC.*

Fig.—*Wight Ill., t.* 163; *Bot. Mag., t.* 1688; *Bentl. and Trim., t.* 198. Sesame (*Eng.*), Sésame de l'Inde (*Fr.*).

Hab.—Throughout the warmer parts of India, cultivated. The leaves, seeds, and oil.

Vernacular.—Til (*Hind., Beng.*), Ellu (*Tam.*), Nuvvulu (*Tel.*), Ellu, Kárellu (*Mal.*), Yellu (*Can.*), Mothetil (*Mar.*), Tal (*Guz.*).

History, Uses, &c.—In Hindu mythology Sesamum seed is symbolic of immortality. According to the "Brahma-purana," Tila was created by Yama, the "king of death," after prolonged penance. The Grihyasutra of Ásvaláyana directs that in funeral ceremonies in honour of the dead, Sesamum seeds be placed in the three sacrificial vessels containing Kusa grass and holy water, with the following prayer: "O Tila, sacred to Soma, created by the gods during the Gosava (the cow-sacrifice, not now permitted), used by the ancients in sacrifice, gladden the dead, these worlds and us!" Sesamum seeds with rice and honey are used in preparing the funereal cakes called Pindas, which are offered to the Manes in the Śraddh ceremony by the Sapindas "or relations" of the deceased.

On certain festivals six acts are performed with Sesamum seeds, as an expiatory ceremony of great efficacy, by which the

Hindus hope to obtain delivery from sin, poverty, and other evils, and secure a place in Indra's heaven. These acts are, *tilodvarti*, "bathing in water containing the seeds"; *tilasnayi*, "anointing the body with the pounded seeds"; *tilahomi*, "making a burnt offering of the seeds"; *tilaprada*, "offering the seeds to the dead"; *tilabhuj*, "eating the seeds"; and *tilavápi*, "throwing out the seeds." Water and Sesamum seeds are offered to the Manes of the deceased. In the first act of Sakuntala this practice (called *Til-anjli*) is alluded to by the anchorite's daughter in love with King Dushyanta, when she tells her companions that if they do not give their assistance, they will soon have to offer her water and Sesamum seeds. (*De Gubernatis.*) In proverbial language a grain of Sesamum signifies the least quantity of anything—*Til chor so bajjar chor*, "who steals a grain will steal a sack"; *Til til ka hisab*, "to exact the uttermost farthing."

A worthless person is compared to wild Sesamum (Jartila, *Sans.*) which yields no oil—*In tilon men tel nahin*, "there is no good in him." Dutt remarks:—"The word Taila, the Sanskrit for oil, is derived from Tila; it would therefore seem that Sesamum oil was one of the first, if not the first oil manufactured from oil-seeds by the ancient Hindus. The Bhávaprakása describes three varieties of Til seeds, namely, black, white, and red. Of these the black is regarded as the best suited for medicinal use; it yields also the largest quantity of oil. White Til is of intermediate quality. Til of red or other colours is said to be inferior and unfit for medicinal use. Sesamum seeds are used as an article of diet, being made into confectionery with sugar or ground into meal. Sesamum oil forms the basis of most of the fragrant or scented oils used by the natives for inunction before bathing, and of the medicated oils prepared with various vegetable drugs. It is preferred for these purposes from the circumstance of its being little liable to turn rancid or thick, and from its possessing no strong taste or odour of its own. Sesamum seeds are considered emollient, nourishing, tonic, diuretic, and lactagogue. They are said to be especially serviceable in piles, by regulating the bowels and removing constipation. A poultice made of the seeds is applied to ulcers. Both the seeds and the oil are used as demulcents in dysentery and urinary diseases in combination with other medicines of their class." (*Mat. Med. of the Hindus*, p. 216.)

Mahometan writers describe the seed under the Arabic name of Simsim. In Africa it is called Juljulán,* and in Persia Kunjad. The Mahometan bakers always sprinkle the seeds upon their bread, the sweetmeat-makers mix them with their sweets. The following Delhi street-cry indicates the properties attributed to them by the latter class of people: —

"Til, tikhur, tisi, dána,
Ghi, shakkar meṅ sána,
Kháë buddha, hoe javána."

"Sesamum, tikhur, and linseed,
Butter and sugar, poppy seed,
Old men it makes quite young with speed." (*Fallon.*)

The oil, which is called in Arabic Duhn-el-hal, is used for the same purpose as olive oil is in Europe. Sesamum is considered fattening, emollient, and laxative. In decoction it is said to be emmenagogue; the same preparation sweetened with sugar is prescribed in cough; a compound decoction with linseed is used as an aphrodisiac; a plaster made of the ground seeds is applied to burns, scalds, &c.; a lotion made from the leaves is used as a hair-wash, and is supposed to promote the growth of the hair and make it black; a decoction of the root is said to have the same properties; a powder made from the roasted and decorticated seed is called Ráhishi in Arabic and

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* جلجلان That which is جليل (a thing) great in estimation. (Ibn Abbád in Táj-el-Arús.)

(*2nd*)—The fruit of Coriander. (Siháb, Mughrib, Kámús.)

(*3rd*)—Sesame. (Sihâh, Ez-Zamakhsherí, Mughrib, Táj-el-Arús.) Sesame in its husk before it is reaped. (Siháh.) The grain of Sesame. (Kámús.)

(*4th*)—The heart's core. *Lane, Madd-el-Kamús.* The name Simsim is applied by the Arabs in the present day to *S. indicum*, but formerly signified the seed of another plant called by the Persians *Jilbahang* and *Zardkhár*, and having purgative properties like hellebore.

Arwah-i-Kunjad in Persian; it is used as an emollient, both externally and internally.

Sesamum (σήσαμον) is frequently mentioned by Greek and Latin authors. Lucian (*Pisc.* 41) speaks of a σησαμαῖος πλαχους: this was probably similar to the *til ka laddu* of India.

Sesame oil was an export from Sind to Europe, by way of the Red Sea, in the days of Pliny. In the Middle Ages the plant was known as Suseman or Sempsen, a corruption of the Arabic Simsin or Samsim. It is now called by Europeans, both in India and Europe, *Jinjili, Jugeoline, Gigeri, Gengeli,* or *Gingelly,* which appear to be corruptions of the word Juljulán. The oil is one of the most valuable of Indian vegetable oils; it keeps for a long time without becoming rancid, and is produced in large quantities in almost every part of the Peninsula. The following mode of preparation is described in the Jury reports of the Madras Exhibition:—"The method sometimes adopted is that of throwing the fresh seeds, without any cleansing process, into the common mill, and expressing in the usual way. The oil thus becomes mixed with a large portion of the colouring matter of the epidermis of the seed, and is neither so pleasant to the eye nor so agreeable to the taste as that obtained by first repeatedly washing the seeds in cold water, or by boiling them for a short time, until the whole of the reddish-brown colouring matter is removed and the seeds have become perfectly white. They are then dried in the sun, and the oil expressed as usual. The process yields from 40 to 44 per cent. of a very pale straw-coloured sweet-smelling oil, an excellent substitute for olive oil."

Hydraulic presses are now in use in the more civilized parts of India for extracting the oil, but have as yet by no means superseded the native oil mill.

Sesamum oil may be used for plaster-making, but it takes more oxide of lead than groundnut oil, and does not make so light-coloured or so hard a plaster. After a prolonged trial at the Government Medical Store Department in Bombay, its use was abandoned in favour of the latter oil for the following reasons:—The rolls of Sesame oil plaster soften in hot weather. The plaster has a disagreeable odour. It darkens in colour when kept for any time. For liniments and ointments, except Ung. Hydr. Nitratis, it appears to be a perfectly satisfactory substitute for olive oil. F. H. Alcock (*Pharm. Journ.* [3], xv., 282) recommends its use in making Lin. Ammoniæ B. P. Sesame or Benne leaves, preferably in the fresh state, are much used in America as a demulcent in disorders of the bowels; they yield an abundant mucilage.

Description.—Annual, 2 to 3 feet; leaves opposite or upper ones alternate, ovate, oblong or lanceolate, the lower ones often 3-lobed, or 3-divided, feather-nerved; at the base of the peduncles are remarkable yellow glands; flowers solitary in the axils, resembling those of the fox-glove, from dirty white to rose-coloured, capsule velvetty and pubescent, mucronate, at first 2-celled, afterwards 4-celled; seeds numerous, without wings, ovoid, flat, white, brown, or black, rather smaller than linseed.

Chemical composition.—The following table shows the relative composition of the brown or Levantine, and yellowish or Indian, seeds:—

	Levantine.	Indian.
Oil	55·63	50·84
Organic matter	30·95	35·25
Ash	7·52	6·85
Water	3·90	7·06

the albuminoids being equal to 21·42 and 22·30 per cent. respectively in the two varieties.

In the manufacture of the oil the seeds are generally pressed three times: twice cold and the third time warm. In Calcutta, where the seeds are only pressed twice, the average yield is—

1st pressing of fine oil	36 per cent.
2nd „ „ ordinary oil	11 „

The oil-cake has the following composition:—

Water	8·25	
Fat	7·63	
Non-nitrogenous matter	40·90	
Albumenoids containing 5·25 per cent. nitrogen	32·82	
Ash	10·40	(*Brannt.*)

For further information on Sesame oil we would refer the reader to Vol. II. of Allen's *Commercial Organic Analysis*, and to Brannt's work on *Oils and Fats*. The authors of the *Pharmacographia* say:—"The oil is a mixture of olein, stearin, and other compounds of glycerin with acids of the fatty series. We prepared with it in the usual way a lead plaster, and treated the latter with ether in order to remove the oleate of lead. The solution was then decomposed by sulphuretted hydrogen evaporated and exposed to hyponitric vapours. By this process we obtained 72·6 per cent. of Elaidic acid. The specimen of Sesame oil prepared by ourselves, consequently, contained 76·0 per cent. of olein, inasmuch as it must be supposed to be present in the form of triolein. In commercial oils the amount of olein is certainly not constant.

"As to the solid part of the oil, we succeeded in removing fatty acids, freely melting after repeated crystallizations at 67° C., which may consist of stearic acid mixed with one or more of the allied homologous acids as palmitic and myristic. By precipitating with acetate of magnesium, as proposed by Heintz, we finally isolated acids melting at 52·5 to 53°, 62 to 63°, and 69·2° C., which correspond to myristic, palmitic, and stearic acids.

"The small proportion of solid matter which separates from the oil on congelation cannot be removed by pressure, for even at many degrees below the freezing point it remains as a soft magma; in this respect Sesame oil differs from that of olive.

"Sesame oil contains an extremely small quantity of a substance, perhaps resinoid, which has not yet been isolated. It may be obtained in solution by repeatedly shaking five volumes of the oil with one of glacial acetic acid. If a cold mixture of equal weights of sulphuric and nitric acids is added in like volume, the acetic solution acquires a greenish yellow hue. The same experiment being made with spirit of wine substituted for acetic acid, the mixture assumes a blue colour, quickly changing to greenish yellow. The oil itself being gently shaken with sulphuric and nitric acids takes a fine green hue, as shown in 1852 by Behrens, who at the same time pointed out that no other oil exhibits this reaction. It takes place even with the bleached and perfectly colourless oil. Sesame oil added to other oils, if to a larger extent than 10 per cent., may be recognised by this test. The reaction ought to be observed with small quantities, say 1 gram. of the oil and 1 gram. of the acid mixture previously cooled."

J. F. Tocher recommends the use of hydrochloric acid with a little pyrogallol for detecting the presence of Sesame oil; 14 parts of the acid and 1 part of pyrogallol are to be placed with an equal proportion of the oil to be tested in a test tube, which is corked and well shaken. The tube is then to be allowed to stand for five minutes, when, the upper layer of oil having been removed by a pipette, the acid solution is boiled for five minutes. If Sesame oil is present, it will show a purple colour when viewed by transmitted light, and a blue colour by reflected light; the latter colour is best observed when the fluid is poured into a porcelain capsule. After a time a slight blue precipitate is thrown down. Olive oil tested with this re-agent afforded a faint yellowish colour, almond, groundnut and rape oils no colour, and cotton-seed oil a very pale red. An admixture of 1 to 2 per cent. of Sesame oil with olive oil may thus be detected.

The substance obtained by Flückiger on shaking Sesame oil with acetic acid has also been investigated by Tocher; he found it to be best obtained by using 7 volumes of acetic acid to 10 volumes of oil. After removal of the acid a brown transparent gelatinous residue was left, which, upon agitation with weak potash solution and rest for twelve hours, afforded a deposit, which, after being well washed with distilled water, was boiled with hydrochloric acid, collected on a filter, thoroughly washed to free it from acid, and dried over a water bath. It was then soluble in alcohol and crystallized on cooling from its alcoholic solution in long needles melting at 117—118° C. The needles were soluble in benzene, oil of turpentine, bisulphide of carbon, chloroform, and glacial acetic acid, but insoluble in water, alkaline solutions, and hydrochloric acid. They were neutral to test paper, and gave no colour reaction with the hydrochloric acid and pyrogallol solution, showing that this reaction is due to another principle in the oil which has not yet been isolated. (*Pharm. Journ.*, Jan. 24th, 1891.)

Sesame oil extracted by ether has a sp. gr. of 0·919 at 23° C.

Commerce.—Sesamum is commonly cultivated in India; there are two varieties, the black-seeded and the white-seeded; the former being generally known as *til,* and the latter as *tili. Til* ripens rather later than *tili,* and is more commonly grown, mixed with high crops, such as *Sorghum vulgare,* while *tili* does best when mixed with cotton. *Tili* oil is preferred of the two for human consumption. (*Duthie and Fuller.*)

The quantity of seed shipped from British India in the year 1871-72 was 565,854 cwts., of which France took no less than 495,414 cwts. In 1881-82, the exports from Bombay alone were 994,120 cwts., valued at Rs. 64,84,475. France continued to take about 4-6ths of the total exports. Besides this, 105,344 gals. of oil, value Rs. 1,12,122, were exported to Eastern ports. In 1884-85, the exports from the whole of India were 2,654 thousand cwts., and in 1887-88, 137 thousand tons, but in 1888-89 the exports fell to 77 thousand tons. This fall was probably due to an unfavourable season. No statistics of the consumption of the oil in India are available. It must be enormous, as Sesame oil is the food oil of all who can afford it.

PEDALIUM MUREX, *Linn.*

Fig.—*Burm. Fl. Ind., t.* 45, *f.* 2; *Gärtn. Fruct. i., t.* 58; *Wight Ic., t.* 1615; *Rheede Hort. Mal. x.,* 72.

Hab.—Deccan Peninsula, Ceylon. The leaves and fruit.

Vernacular.—Bara-gokhru (*Hind.*, *Beng.*), Peru-nerunji (*Tam.*), Pedda-palleru (*Tel.*), Káttu-nerinnil (*Mal.*), Anne-galu-gida (*Can.*), Kadva-gokhru (*Guz.*), Karonta, Ubha-gokhru, Malvi-gokhru (*Mar.*).

History, Uses, &c.—This plant does not appear to have been used medicinally by the ancient Hindus, nor do we know of any Sanskrit name for it. It is supposed by Dr. Moodin Sheriff to be the Faríd-búti (herb Faríd), the plant upon which Shaik Faríd-ed-dín Shakar Ganj,* a Mahometan ascetic and poet, sustained life while he acquired the everlasting treasure of knowledge (Ganj-i-la-yazál-i-maárif). The following quatrain is attributed to him:—

Shabníst keh khún-i-dil-i-ghamnák naríkht. |
Rúzí neh keh ábrú-i-man pák naríkht, ||
Yak sharbat-i-áb-i-khúsh nakhúrdam hameh 'umr. |
Kán níz z'rah-i-dídeh bar khák naríkht. ||

By night I am consumed with grief,
By day I am overwhelmed with shame,
No drop of sweet water passes my lips,
But it pours in tears from my eyes.

P. Murex is the Caca-mullu of Rheede, who states that the powdered leaves are given in two-drachm doses with milk and sugar in gonorrhœa and gonorrhœal rheumatism. The fresh plant agitated in water or milk renders it gelatinous without materially altering its taste, colour or odour. This thickening disappears after some hours. A watery infusion of this kind sweetened with sugar is a favourite and excellent demulcent in acute gonorrhœa. The dried fruit is the Bara-gokhru or "great Gokhru" of the shops, and a decoction of it is used when the fresh plant is not obtainable. In the Concan a *Paushtik*, or "strengthening medicine," is made of the powdered fruit with *ghi*, sugar, and spices; it is taken with milk.

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* Shakarganj or "sugar store." Poison in his mouth became sugar—

سنگ در دست او گوهر گردید ∴ زهر در کام او شکر گردید

His shrine is at Pák-pattan, or the Ferry of the Pure; he died A. H. 664, ninety-five years of age. Pák-pattan is in the Panjáb, between Bahwalpúr and Firúzpur, in the Sutlej Valley.

Dr. Emerson has observed that the juice is used as a local application to aphthæ.

P. Murex must not be confounded with the great Gokhru or Hasak of Mahometan medical writers, which is *Xanthium Strumarium.*

European writers upon Indian drugs bear evidence to the correctness of the native estimate of the medicinal value of Gokhru, and it has lately been introduced into European practice as a remedy for nocturnal seminal emissions, incontinence of urine and impotence. (*Practitioner*, XVII., 381.) It has been given in an infusion of 1 oz. of the fruit to 1 pint of boiling distilled water, this quantity being taken daily.

Description.—A spreading, low succulent plant with oval, dentate, obtusely pointed leaves; pedicels axillary, 1-flowered, shorter than the petiole, 1 to 2, or more dark-brown glandular bodies situated near the axils; flowers yellow; tube of corolla about 1 inch long; fruit pendulous, about ½ an inch long, and ¼ inch in diameter at the base, 4-angled, with a straight spine at the base of each angular ridge; above the spines is a narrow portion which is inserted into the 5-clawed calyx; when dry the fruit is corky, it is divided into two cells; the seeds are elongated, narrow, and four in number. The young branches, petioles, under-surface of leaves and immature capsules have a frosted appearance, which is due to the presence of numerous small, sessile, brilliant, crystalline, 4 to 5-partite glands. The substance of the fruit consists, in great part, of dense fibro-vascular tissue, forming a kind of 4-winged nut; the corky part consists of delicate cellular tissue; when fresh it is green and succulent. The fresh plant has a peculiar disagreeable musky odour. Simple agitation of the young branches in water, without any crushing, produces a viscid mucilage like white of egg. We find from experiment that the glandular crystalline bodies described above are the source of the mucilage; if they are gently scraped from the under-surface of the leaf and mixed with water, the viscidity is at once produced. The mucilage has a faint peculiar taste, but is not disagreeable.

Chemical composition.—The fruits contain a greenish-coloured fat, a small quantity of resin, and an alkaloid in the alcoholic extract. The mucilage separated by water is precipitated by acetate of lead solution and alcohol, and in these respects resembles the mucilage of gum arabic. The ash of the air-dried fruit amounts to 5·43 per cent.

Martynia diandra, *Glox. Bot. Rep.* 575, "tiger's claw" or "devil's claw," is a native of Mexico, but has become quite naturalized in India, making its appearance on waste ground during the rainy season.

The plant is herbaceous, has large cordate leaves, and handsome flowers like those of Sesame. The fruit is a green fleshy capsule which contains a hard, black, woody, wrinkled nut with two anterior hooks, having something the appearance of a beetle. The natives liken it to a scorpion, hence the names *Vinchú* and *Vichhidá;* they suppose it to have a curative effect upon the sting of that reptile, the nut being rubbed down with water and applied to the injured part. It is sold in the shops.

ACANTHACEÆ.

HYGROPHILA SPINOSA, *T. And.*

Fig.—*Wight Ic., t.* 449; *Rheede, Hort. Mal. ii., t.* 45.

Hab.—Throughout India. The plant and seeds.

Vernacular.—Tálmakhára, Tálmakhána (*Hind.*), Kuliakhára (*Beng.*), Kolista, Kolsunda (*Mar.*), Ekháro (*Guz.*), Kulugolike, Kolavalike (*Can.*), Nirmulli (*Tam.*), Nirugobbi (*Tel.*), Vayal-chulli (*Mal.*).

History, Uses, &c.—This plant bears the Sanskrit names of Ikshura, Kshura, Ikshugandha, and Kokiláksha, "having eyes like the Kokila, or Indian Cuckoo." The bluc flowers are used in the *Lákholi* ceremony, which is an offering to Mahadeva of a lakh each (100,000) of the five grains (पंचधान्यें), and a lakh each of a number of different flowers. Counting these occupies the women of the house for about a month. As a medicine the Hindus consider *H. spinosa* to be cooling, diuretic, and strengthening; the root, seeds, and ashes of the plant are in general use, and are prescribed in hepatic obstruction with dropsy, rheumatism, and urinary affections. The seeds are one of the *Pancha-vija*, or "five seeds," the others being those of Celastrus, Fenugreek, Ajwan, and Cumin. There are, however, several other sets of five seeds. Mahometan writers mention the use of the plant for the same purposes, and also its external application in rheumatism, but they notice more especially the use of the seeds as an aphrodisiac given either with sugar, milk or wine in doses of from one to three dirhems. Ainslie, speaking of this plant, say:—" This root, which has got its Tamool name from growing near water, is supposed to have virtues similar to those of the Moollie-vayr (*Solanum indicum*, Linn.) already mentioned. The plant is the *Bahel-schulli* of Rheede, who tells us that on the Malabar Coast a decoction of the root is considered as diuretic and given in dropsical cases and gravelish affections; the dose is about half a teacupful twice daily. The species in question is a native of the Western Coast of India, whence the root is brought across the peninsula to the medicine bazars of the Carnatic. Our article is called Katu-irki by the Cingalese." (*Mat. Ind.*, II., p. 236.) In the *Pharmacopœia of India* several European contributors bear testimony to the diuretic properties of the plant, but no mention is made of the use of the seeds as an aphrodisiac and diuretic. In Bombay they are very generally used and are to be found in every druggist's shop.

Description.—Roots often biennial, tapering, with numerous rootlets; stems herbaceous, ascending or erect, ramous, jointed, a little flattened, hairy, from 2 to 3 feet high; branches opposite, like the stem, and also nearly erect; leaves an exterior, opposite, sessile pair at each joint, within these and subalternate with the spines, several small ones in a verticel: all are linear-lanceolate, margins often revolute, hairy, almost bristly, size various; spines 6 in each verticel, between the leaves and flowers, awl-shaped, spreading and a little recurved; flowers verticelled, numerous, sessile, large, of a bright blue; bracts lanceolate, margins and outside bristly; calyx of two pairs of nearly equal leaflets, clothed with soft hair; corol 2-lipped, lips nearly equal; upper 2-parted, with the division emarginate, the under one 3-parted, with the division also emarginate, in the under a coloured body like a large oblong anther; filaments connected at the base, second pair larger than usual in the genus; anthers sagittate; stigma subulate, involute, with a fissure on the upper side. (*Roxb.*) The seeds are small and flattish, of irregular form and brown colour, the largest $\frac{1}{10}$ of an inch long and $\frac{1}{16}$ broad. When placed in the mouth they immediately become coated with a large quantity of extremely tenacious mucilage, which adheres to the tongue and palate and is of rather agreeable flavour.

Microscopic structure.—When a section of the seed is placed under the microscope with a drop of water the development of the mucus may be observed. It appears to spring in filaments from the columnar cells of the testa; these spread rapidly in every direction and form a network which resembles the growth of some of the lower forms of algæ; it does not dissolve when much water is added.

Chemical composition.—The roots with the lower portion of the stems were air-dried, contused, and exhausted with 80 per cent. alcohol. On concentrating the tincture, white cauliflower-like masses separated. After the whole of the alcohol had been evaporated off, the extract, which had a very strong acid reaction, was mixed with water and agitated with petroleum ether, then with ether, and finally, after having been rendered alkaline, re-agitated with ether. The petroleum ether solution on evaporation left a crystalline residue, partly in the form of white cauliflower-like nodules, and a crystalline deposit on the sides of the dish. Examined microscopically, both the nodules and the deposit were seen to consist of rod-shaped crystals. After repeated crystallization from alcohol, and pressing the crystals between blotting paper, by which much colouring matter and a trace of oil was separated, the residue, which was nearly white, possessed the following properties:—On being heated between watch-glasses it melted into an amber-coloured fluid, and after the lapse of some hours the glasses were filled with a white, wool-like sublimate. In water the principle was insoluble, and it was not acted upon by ammonia or dilute sodium hydrate. In concentrated sulphuric acid it dissolved with a yellow coloration, and on dilution the solution became milky. On gently heating the sulphuric acid solution and then diluting with water, a pinkish turbid fluid resulted; when chloroform was agitated with this fluid it became coloured either pink, violet, greenish or even blue, the tint appearing to depend on the degree of heat applied to the acid solution before dilution with water. The principle dissolved in chloroform, and the solution when agitated with an equal volume of concentrated sulphuric acid, failed to give the colour reaction in the chloroform layer for cholesterin, but the sulphuric acid stratum exhibited a very marked green fluorescence.

Evaporated to dryness with nitric acid a yellow residue was left, which, on the addition of ammonia, became of an orange-yellow colour, but without any trace of redness. When the solid principle was evaporated to dryness with HCl and ferric chloride, it was difficult to say what colour the residue was. The test, however, applied as described by C. Forti (*Stay. Sperim. Agri. Ital.* 18, 580), by first dissolving the principle in chloroform, adding a little strong ferric chloride and concentrated hydrochloric acid, and evaporating to dryness, left a dark-coloured residue; this, when dry and cold, was treated with chloroform and gently warmed, when a fine violet-coloured solution was afforded. The acid ethereal extract contained yellow colouring matter and possessed an aromatic odour. The alkaline ethereal extract contained a principle which afforded in a marked degree alkaloidal reactions, but we failed to obtain any special colour tests.

The seeds are glutinous, besides being mucilaginous. They contain 4·92 per cent. of nitrogen, which is equivalent to 31·14 per cent. of albuminoids, traces of an alkaloid, and 23 per cent. of a yellow fixed oil. The mucilage is not affected by ferric chloride, plumbic acetate, or by two volumes of alcohol.

Commerce.—The seeds are kept by all druggists. Value Rs. 6 per maund of 37½ lbs. The root is an article of commerce in Southern India; elsewhere it is generally supplied by the herbalists.

Several species of **Strobilanthes** yield stems as thick as a walking-stick and quite straight, which are used, like bamboos, in the construction of mud walls and fences. The aromatic flower spikes of some of these plants are used as a rustic medicine by the natives. The bark of *S. callosus*, Nees, with an equal quantity of Undi bark (*Calophyllum inophyllum*), is used in Western India as a fomentation in tenesmus; the bark-juice, with an equal quantity of Máka-juice (*Eclipta alba*), boiled to one-half, is mixed with old Sesamum oil, a few peppercorns and ginger, heated and applied in parotitis; equal parts of the juice of the flowers and of those of *Randia dumetorum* are used as an application to bruises.

The flower spikes of this plant resemble hops in shape and size, and are covered with a viscid resinous exudation called *Mél*, having a musky and resinous odour.

BLEPHARIS EDULIS, *Pers.*

Fig.—*Burm. Fl. Ind., t.* 42; *Delile Fl. Æg., t.* 33, *f.* 3.

Hab.—Punjab, Sind, Persia. The seeds.

Vernacular.—Utanjan (*Ind. Bazars*).

History, Uses, &c.—Under the local name of Utanjan and the Persian name Anjurah, an Acanthaceous seed is sold in the Indian bazars. From an examination of the capsules which are sometimes found mixed with the seeds, there would appear to be little doubt that they are those of the plant placed at the head of this article. Utanjan is a standard native remedy and is universally kept in the druggists' shops. The author of the *Makhzan-el-Adwiya* (article Anjurah) gives us the following account of it, from which it would appear that the true Anjurah is the *Urtica prima* of Matthiolus (*U. pilulifera*, Linn.),[*] and that the seeds now in use in India have somehow come to take the place of the genuine article. He says:—"Anjurah is a Persian word; it is the Karíz of the Arabs, the Kurnah of Shiraz, the Kajít of the Turks, the Utanjan of the Indians, the Urtikparim of Latin writers, and the Harkitah of Gilan. The plant has numerous serrate leaves, which are armed with prickles, the stem is still more prickly; when it comes in contact with the body it causes redness, burning, and itching. The flowers are yellow. The seeds smooth and shining, flattened, of a brownish colour, larger than those of Sesamum, and altogether not unlike linseed. They are the officinal part, and if good should be heavy and of a brown colour." Medicinally they are considered to be attenuant, resolvent, diuretic, aphrodisiac, expectorant, and deobstruent.[†]

Description.—The Utanjan of the Indian shops consists of the seeds mixed with a variable proportion of broken pieces of the capsule and a few entire fruits. The latter are mitre-shaped, about $\frac{3}{10}$ of an inch long and $\frac{2}{10}$ broad, laterally compressed, sides furrowed, surface polished, of a chestnut colour; capsule 2-celled, 2-seeded; seeds heart-shaped, flat, covered with long, coarse hairs; when soaked in water the hairs disintegrate and produce a large quantity of viscid mucilage.

Microscopic structure.—Each hair is made up of several columnar cells, each of which contains a spiral fibre, which upon the solution of the cell wall uncoils and imparts an unusual stringiness to the mucilage.

Chemical composition.—The bitter principle of the seeds is a white crystalline body soluble in water, amylic and ethylic alcohol, but insoluble in ether and petroleum ether. It gives a reddish colour with sulphuric acid, green at the margin if impure, and is best distinguished by the fine violet colour its solutions impart when brought into contact with ferric salts. With H^2SO^4 and $K^2CR^2O^7$ an agreeable odour of salicylous acid is evolved. It is associated with a substance which reduces Fehling's solution. Another white crystalline principle is present in the seeds which is not bitter, and does not give colour reactions with sulphuric acid and ferric salts. The latter crystals melted on the surface of heated mercury at 225°. The aqueous extract of the seeds contained much mucilage and vegetable albumen. The ash amounted to 7·1 per cent.

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[*] The Roman Nettle, *Urtica prima*, Matth. Valgr. v. 2, 469. It has brown polished seeds.

[†] Conf. Dios. iv., 89. περὶ ακαλύφης, also Galen; they recommend it as an expectorant.

Commerce.—Utanjan is imported into Bombay from Egypt. Value Rs. 1½ per lb. In Sind and Northern India it is collected locally.

ACANTHUS ILICIFOLIUS, *Linn.*

Fig.—*Rheede, Hort. Mal. ii., t.* 48. Holly-leaved Acanthus (*Eng.*).

Hab.—Sea Coasts of Malabar, Ceylon, and the Sunderbunds. The plant and root.

Vernacular.—Hárkúchkánta (*Hind., Beng.*), Márándi (*Mar.*), Moranna (*Goa.*), Paina-schulli (*Mal.*).

History, Uses, &c.—Roxburgh states that the Sanskrit name of this plant is Hárikasa, but we cannot find any plant bearing this name mentioned by Hindu medical writers.

Ainslie calls the plant " Holly-leaved Acanthus," and says that Rheede mentions the use of the tender shoots and leaves ground small and soaked in water as an application to snake-bites. Bontius commends its expectorant qualities. It is a plant in great request among the Siamese and Cochin-Chinese, and is called by the latter *Cay-o-ro,* who consider the roots to be cordial and attenuant, and useful in paralysis and asthma. (*Flora, Cochin Chin.,* Vol. II., p. 375.) In the Concan a decoction of the plant with sugar-candy and cumin is given in dyspepsia with acid eructations. In Goa the leaves which abound in mucilage, are used as an emollient fomentation in rheumatism and neuralgia.

Description.—A common shrub in and on the edges of salt or brackish lakes, marshes, &c. Roots ramous, stems many, erect; branches few, bark smooth; prickles stipulary, four-fold, short, but very sharp. Leaves opposite, short-petioled, oblong, scolloped, waved, spinous, dentate; polished on both sides, of a firm texture, from four to six inches long, and about two broad. Spikes generally terminal, sometimes axillary, erect. Flowers solitary, opposite, large, blue, inodorous. Capsule oblong, ovate, smooth, size of an acorn, 2-celled, 2-valved. Seeds two in each cell, obliquely cordate, compressed. (*Roxburgh*).

Chemical composition.—The powdered leaves yielded to ether a quantity of fatty matter coloured strongly with chlorophyll and some soft resins. Alcohol removed more resin, an organic acid, and a bitter alkaloid. The alkaloid gave a reddish-brown colour with sulphuric acid, and was precipitated from its solutions by the usual reagents, including the volatile and fixed alkalies. Some soluble saline matter was present in the extracts of the leaves, and contributed largely to the 16·4 per cent. of total ash obtained from the air-dried leaves.

BARLERIA PRIONITIS, *Linn.*

Fig.—*Rheede, Hort. Mal. ix., t.* 41; *Wight Ic.*, 452; *Rumph. Herb. Amb. vii.*, 13.

Hab.—Tropical India. The plant.

Vernacular.—Jhinti, Katsareya (*Hind.*), Kántajáti (*Beng.*), Vajradanti, Kalsunda, Pivala-koránta (*Mar.*), Shemmulli, Vara-mulli (*Tam.*), Múlu-govinda (*Tel.*); Kánta-shelio (*Guz.*), Goratige, Gorati (*Can.*).

History, Uses, &c.—This small shrub is the Kuranta, Kuruvaka or Kuravaka of the Hindu poets, who compare its yellow flowers to a flash of lightning. In the Gita Govinda the jealous Radha pictures to herself the absent Hari binding them in the floating locks of the Gopis. Other Sanskrit names are Amlana, Pitajhinta, Mahasaha, and Kuruntaka. Though not mentioned in the Nighantas, its medicinal properties appear to be very generally known; it is the *Coletta Veetla* of Rheede, and the *Hystrix frutex* of Rumphius.

The natives apply the juice of the leaves to their feet in the rainy season to harden them, and thus prevent the maceration and cracking of the sole which would otherwise occur. Ainslie says that the juice of the leaves, which is slightly bitter and acid, is a favourite medicine of the Hindus of Lower India in those catarrhal affections of children which are accompanied with fever and much phlegm ; it is generally administered in a little honey or sugar and water in the quantity of two tablespoonfuls twice daily. (*Materia Indica*, II., p. 376.)

In the Concan the dried bark is given in whooping cough, and 2 tolás of the juice of the fresh bark with milk in anasarca. Dr. Bidie observes that it actsas a diaphoretic and expectorant.

A paste is made of the root which is applied to disperse boils and glandular swellings, and a medicated oil, made by boiling the leaves and stems with sweet oil until all the water has been driven off, is used as a cleansing application to wounds.

Description.—Stem short, erect; branches numerous, opposite, erect, round, smooth; the whole plant two or three feet high. Thorns axillary, generally about four, straight, slender, sharp. Leaves opposite, decussate, short-petioled, oblong, somewhat waved, mucronate, smooth. Flowers axillary, generally solitary, sessile, large, yellow. Capsule conical, 2-seeded, one seed in each cell. Root woody, perennial, with numerous lateral rigid rootlets.

Chemical composition.—With the exception of the large amount of a neutral and acid resin soluble in light petroleum ether, nothing of special interest was detected: there was no trace of any alkaloidal principle.

Barleria noctiflora, *Linn.* Dr. Mootooswamy says that in Tanjore a decoction of this plant is a good adjunct to and substitute for human milk.

The following plant is classed by the natives along with the Barlerias, of which *B. cristata* and several other species appear to be included by the Sanskrit names Kuruntaka, Kuruvaka, and Artagala. In Hindi Jhinti is a kind of general name for these plants, and in Marathi Koránta and Áboli.

Crossandra undulæfolia, *Salisb. Bot. Mag.* 2186; *Wight Ic., t.* 461; *Rheede, Hort. Mal. ix.*, 62, is a native of the Deccan Peninsula and Ceylon, and is much cultivated about Hindu temples in other parts of India, probably on account of the colour of the flowers, which is like that of the dress of the Bhikshu or penitent. The plant bears the synonym of Priyadarsha, "pleasant to look at," and the flowers are much worn by Brahmin women in the hair. The capsules, which resemble grains of barley, are described in the *Makhzan-el-Adwiya* under the Arabic name of Asába-el-usúl as highly aphrodisiac; they afford much amusement to children from their peculiarity of suddenly bursting with a crack when moistened and projecting their seeds.

Dædalacanthus roseus, *T. And.*, a native of Western India, has tuberous, spindle-shaped roots, usually ten in number, as thick as a quill, several inches in length and covered by a dark-brown bark; leaves elliptic, glabrous, scabrous on the veins beneath; spikes axillary-peduncled, imbricated; bracts oval, somewhat wedge-shaped, acute, ciliated, with long hairs, reticulately veined; tube of corolla very long and slender; flowers deep blue, turning bright red as they fade. The root boiled in milk is a popular remedy for leucorrhœa; dose one drachm. In the Southern Concan it is given to pregnant cattle to promote the growth of the fœtus. The Marathi name is Dasamuli, "having ten roots."

Neuracanthus sphærostachyus, *Dalz. Hook. Ic. Pl., t.* 835, is a native of Western India. It is powdered and made into a paste which is used to cure ringworm, and the roots are administered in that form of indigestion in which fatty or saponaceous grape-like masses are observed in the stools. They resemble Serpentaria in appearance, but may be distinguished by the thick covering of white, silky hairs upon the root stock. The roots have hardly any taste. The Marathi name is Ghosvel.

ANDROGRAPHIS PANICULATA, *Nees.*

Fig.—*Bentl. and Trim.*, *t.* 197; *Wight Ic.*, *t.* 518; *Rheede, Hort. Mal. ix.*, *t.* 56.

Hab.—Throughout India, wild or cultivated. The herb.

Vernacular.—Kiryat (*Hind.*), Olen-kiraita (*Mar.*), Kálmeg (*Beng.*), Shirat-kuchchi, Nila-vembu (*Tam.*), Nela-vemu (*Tel.*), Nila-veppa (*Mal.*), Nela-bevinagida (*Can.*), Kiryáto (*Guz.*).

History, Uses, &c.—Concerning this plant, Dutt (*Hindu Mat. Med.*, p. 216) states that there is some doubt regarding its Sanskrit name. He says:—"A plant called Yavatiktá, with synonyms of Mahátikta, Sankhini, &c., is said by some to mean this herb, but the term Mahátikta, when occurring in Sanskrit prescriptions, is usually interpreted as *Melia sempervirens*, Sw.,* and Yavatiktá has not been noted by me as having occurred in any prescription, so that I am inclined to think *Andrographis paniculata* was not used in Sanskrit medicine. The plant is well known in Bengal under the name of Kálmeg, and is the principal ingredient of a domestic medicine called *Alui*, which is given to infants for the relief of griping, irregularity of the bowels, and loss of appetite." It is prepared in the following manner:—Take equal parts of cumin, *randhani* (fruit of *Carum Roxburghianum*), aniseed, cloves, capsules of greater cardamoms, and pound them thoroughly with the expressed juice of the leaves of the Kálmeg. The mass thus prepared is divided into small pills and dried in the sun. The dose is one pill rubbed down in human milk.

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* *M. Azedarach*, Linn.

Both Hindu and Mahometan medical writers would appear to have confounded this drug with chiretta.* According to Forskahl, it is common in Arabia, and is there called *Wizr.* (*Forsk. Flor. Aeg. Ar.*, CII.)

Moodin Sheriff points out that *Cara Caniram*, the name given to this plant by Rheede, signifies "Black Strychnos;" he therefore thinks it must be incorrect.

Ainslie speaks of the plant as having been brought to the southern parts of the Indian Peninsula from the Isle of France.

Flückiger and Hanbury in their *Pharmacographia* point out that it has been wrongly supposed to be a constituent of the famous bitter tincture called by the Portuguese of India *Droga amara.* In the *Pharmacopœia of India* it has been made official, and directions for making a compound infusion and compound tincture are given. Quite recently, under the name of *Halviva,* which appears to be a corruption of the Bengali word *alui* or *alvi*, a preparation of the drug has been advertised in England as a substitute for quinine. The herb is very common in shady situations as a weed of cultivation, and is much used by the natives as a domestic remedy for fever in combination with aromatics, especially with lemon-grass. The dose of the dried leaves is about ten grains combined with twenty grains of black pepper. In the Concan, Kirait, Ginger, and Dikamali are given in fever, and the fresh juice with black pepper, rock salt, and Asafœtida in colic. In the chronic febrile condition known as *Bariktáp,* Kirait, Ginger, Picrorhiza root, wild dates, and Conessi bark are infused and given with honey every morning. **A. echioides,** *Nees*, is said to have similar medicinal properties; it is the *Peetumba* of Rheede (ix., 46), who says that the juice is given in fever. **Haplanthus verticillaris,** *Nees,* and **H. tentaculatus,** *Nees,* bear the name of *Kala-kirait* in Western India, and are used medicinally. The Hindi name for these two plants is *Kastula* and the Marathi *Jhánkara.*

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* The name *Kiryat* is loosely applied to many bitter drugs.

Description.—Annual, 1 to 3 feet; stem quadrangular, pointed, smooth; leaves opposite, on short petioles, lanceolate, entire upper surface dark-green and shining, under surface paler and finely granular: they vary much in size, but the larger are usually about 3 inches in length and 1 inch in breadth; calyx deeply 5-cleft; corolla bilabiate; lips linear, reflected, upper one 3-toothed, lower one 2-toothed; flowers remote, alternate, on long petioles, downy, rose-coloured, or white streaked with purple; capsules erect, somewhat cylindrical; seeds 3 to 4 in each; root fusiform, simple, woody, with numerous fine radicles.

Chemical composition.—According to the authors of the *Pharmacographia*:—"The aqueous infusion of the herb exhibits a slight acid reaction and has an intensely bitter taste, which appears due to an indifferent, non-basic principle, for the usual reagents do not indicate the presence of an alkaloid. Tannic acid, on the other hand, produces an abundant precipitate, a compound of itself with the bitter principle. The infusion is but little altered by the salts of iron; it contains a considerable quantity of chloride of sodium."

Commerce.—*A. paniculata* is not an article of commerce, but the fresh plant is sold by the herbalists and gardeners.

JUSTICIA.

Several species of Justicia are reputed to be medicinal amongst the peasantry.

Justicia Gendarussa, *Linn., f.*, is the *Vedakodi* of Rheede (*Hort. Mal. ix., t.* 42), who says that the juice with mustard is used as an emetic in asthma, and a bath of the leaves in rheumatism. According to Louvet, it is emetic and very efficient in the colic of children. In Réunion it is called "*Guerit petit colique.*"

Description.—In gardens it is usually seen in a stunted form, as it is kept closely cut; the young shoots have a smooth green or purple bark; from the joints, which are somewhat tumid, spring secondary shoots. The leaves are opposite, short-petioled, lanceolar, obtuse, frequently a little scolloped, smooth; nerve and veins purple, or green, according to the variety, from 3 to 6 inches long, and ½ to 1 inch broad; spikes terminal, erect; flowers dirty white, spotted with purple. The odour of the plant when crushed is ferny, the taste peculiar, and not disagreeable.

Justicia procumbens, *Linn. Wight. Ic., t.* 1539, a native of the South Deccan and Ceylon. [*Vern.*—Ghâti-pitpáprá (*Mar.*), Nereipoottie (*Tam.*)] is a small plant, very abundant in the rainy season. The whole herb is gathered when in flower and dried. It has a faintly bitter disagreeable taste, and is used as a substitute for Fumaria, the true Pit-pápré. According to Ainslie the juice of the leaves is squeezed into the eye in cases of ophthalmia (II. 246).

Description.—Stem procumbent, diffuse; leaves lanceolate-elliptic or rounded, glabrous or sparingly hairy; spikes compressed, slender; calycine segments lanceolate, membranous on the margin, minutely ciliated; bracts of the same shape and shorter than the calyx; flowers small, pale purple; root slender, long, woody, straight, with numerous slender stems spreading from the crown. The bitterness of the plant is due to an alkaloid.

Justicia picta, *Roxb. Rheede, Hort. Mal. vi., t.* 60; *Bot. Mag., t.* 1870, a well-known garden shrub, is used medicinally in the same manner as *Adhatoda Vasica.* The variegated variety is called 'White Adulsa,' and the dark-leaved kind 'Black Adulsa'; the first is, according to Rumphius (vi., 35), used pounded with the milk of the cocoanut to reduce swellings. Loureiro states that the leaves are emollient and resolvent, and notices their use as a cataplasm to inflamed breasts caused by obstruction to the flow of milk.

Justicia Ecbolium, now **Ecbolium Linneanum,** *Kurz. Wall. Pl. As. Rar. iii., t.* 108; *Bot. Mag., t.* 1847, is a small shrub, the roots of which have a reputation in the Concan in jaundice and menorrhagia. Rheede (*Hort. Mal. ii.*, 20) notices the use of the whole plant in gouty affections and dysuria.

Description.—Stems several, straight, jointed, and swelled above the joints; woody and round below, quadrangular and tender above; leaves elliptic-oblong, attenuated at both ends, pubescent, or glabrous; spikes terminal, tetragonal; bracts oval, quite entire, ciliated, mucronate, as long as the capsule; flowers azure-coloured; capsule half an inch long, 2-seeded.

ADHATODA VASICA, *Nees.*

Fig.—*Lam. Ill., t.* 12, *f.* 1; *Bot. Mag., t.* 861; *Griff. Ic. Pl. As., t.* 424; *Rheede Hort. Mal. ix., t.* 43. Malabar nut tree (*Eng.*)

Hab.—India, from the Punjab and Assam to Ceylon. The leaves, root, and flowers.

Vernacular.—Arúsa, Rús, Bánsa (*Hind.*), Adúlsa (*Mar.*), Bákas (*Beng.*), Adúlso, Bánsa (*Guz.*), Ádátodai (*Tam.*), Addasaram (*Tel.*), Áta-lotakam (*Mal.*), Ádúsála, Ádúsoge (*Can.*).

History, Uses, &c.—This shrub has a considerable reputation all over India as an expectorant and antispasmodic, and is largely prescribed in consumption and other chest affections attended with cough and hectic fever. Sanskrit writers call it Vasaka, Vansa, Vrisha, Sinha-mukhi "lion-mouthed" Sinhaparni "lion-leaved," and Atarúsha, Atarusha or Atarúshaka, and direct the fresh juice of the leaves to be given in doses of one tolá (180 grs.), with the addition of honey and long pepper, in cough. Dutt, in his *Hindu Materia Medica*, gives several compound preparations of the drug extracted from Sarangadhara and the Bhavaprakasa, and remarks that there is a saying that no man suffering from phthisis need despair as long as the Vasaka plant exists. In the Nighantas it is described as removing phlegm, bile, and impurities of the blood, a remedy for asthma, cough, fever, vomiting, gonorrhœa, leprosy, and phthisis. Persian writers upon Indian Materia Medica notice the plant under its Hindustani name of Arúsa. The author of the *Makhzan-el-Adwiya* describes it correctly, and says that the wood is used to make toothpicks and gunpowder. Medicinally the flowers are useful in hectic, heat of blood, and gonorrhœa, the root in cough, asthma, febrile disturbances, and gonorrhœa; the fruit is sometimes hung round the necks of children to keep them from catching cold. Ainslie states that "In Ceylon, the Malabar nut tree is said to grow to the height of fourteen or fifteen feet, and is there called Wanapala. The flowers, leaves, and root, but especially the first, are supposed to possess antispasmodic qualities; and are prescribed in certain cases of asthma, and to prevent the return of rigor in intermittent fever; they are bitterish and sub-aromatic, and are administered in infusion and electuary. In the last mentioned form the flowers are given to the quantity of about a teaspoonful twice daily." (*Mat. Ind.*, II., p. 3.) Roxburgh remarks that the wood is well fitted for making charcoal for gunpowder. Strong testimony in favour of the remedial properties of the drug was furnished to the authors of the *Pharmacopœia of India* by Drs. Jackson and Dutt, who employed it with marked success in chronic bronchitis, asthma, and other pulmonary and catarrhal affections. Cases illustrative of its effects in catarrh, bronchitis, and phthisis have been published by Mr. O. C. Dutt. (*Indian Annals of Med. Sci.*, 1865, Vol. X., p. 156.) In Bengal the leaves are smoked in asthma; good evidence of their value when thus used has been collected by Dr. G. Watt in the "*Dict. of the Economic Products of India.*" Dr. Watt has also brought to notice the use of Adhatoda leaves in rice cultivation in the Sutlej Valley. The fresh leaves are scattered over recently flooded fields prepared for the rice crop, and the native cultivators say that they not only act as a manure, but also as a poison to kill the aquatic weeds that otherwise would injure the rice. Experiments conducted by us show that the infusion acts upon the cells of these plants in the same manner as certain chemical reagents, by contracting their contents and causing their disintegration; it also proves poisonous to any animalcules, frogs, leeches, &c., present in the water; on the higher animals the leaves do not have this effect.

Description.—A small tree or large shrub, flowering in the cold season; trunk straight; bark pretty smooth, ash-coloured; branches sub-erect, with bark like that of the trunk, but smoother; leaves opposite, short petioled, broad lanceolar, long, taper-pointed, smooth on both sides, about 5 to 6 inches long and 1½ broad; spikes from the exterior axils, solitary, long-peduncled, the whole end of the branchlet forming a leafy panicle, flower-bearing portion short, and covered with large bracts; flowers opposite, large, white, with small ferruginous dots, the lower part of both lips streaked with purple; bracts 3-fold, opposite, 1-flowered, exterior one of the three, large, ovate, obscurely 5-nerved interior pair much smaller, end sub-lanceolate, all are permanent; calyx 5-parted to the base, divisions nearly equal; corolla ringent, tube short, throat ample, upper lip vaulted, emarginate, lower lip broad and deeply 3-parted, both streaked with purple; filaments long, resting under the vault of the upper lip; anthers twin. (*Roxb.*)

Chemical composition.—The powdered leaves have a light green colour with a strong peculiar odour and a bitter taste. One of us has published the following report of a chemical examination: "Soaked in water and then boiled, the powder afforded 34 per cent. of a reddish-brown extract having the characteristic properties of the leaves. Incinerated at a low red heat 17 per cent. of ash was left. A remarkable alkalinity pervaded the drug, which was noticeable in the cold aqueous infusion, in the distillate obtained by boiling with water, and in the fumes given off when burning; the leaves when smoked in a pipe produced no narcotic effect; the chief result of the smoking was the evolution of much ammoniacal vapour among other products of combustion, and to the inhalation of this vapour is probably due the efficacy of the leaves in the relief of asthma. A well-defined alkaloid appears to be the most important constituent; it constitutes the bitter principle, and to all intents and purposes is the active principle. It occurs in white transparent crystals belonging to the square prismatic system, without any odour, but with a decidedly bitter taste. It is soluble in water with an alkaline reaction, and in ether, but more so in alcohol. It readily forms salts with sulphuric, hydrochloric, nitric, and acetic acids; these salts are crystalline, and their solutions may be evaporated without apparent decomposition. It is precipitated by potassio-mercuric iodide, iodine in potassium iodide, tannin, and Nessler's reagents. A solution of the sulphate, observed in a Laurent's polariscope, possessed a slight right-handed rotation. Heated on platinum foil it fused to a yellowish and then to a fine red mass, which afterwards blackened and decomposed. Distilled with strong potash it yielded an oily body resembling chinoline, together with ammonia and other volatile bases. I propose to call this alkaloid "*Vasicine,*" after the Sanskrit name of the plant. In a proximate analysis of the leaves, petroleum ether was first used to remove the volatile oil, or stearopten, which formed one of the odorous principles. Ether was then employed to extract chlorophyll, wax, resins, and a small quantity of alkaloid. The alcoholic extract was the most interesting, as it contained most of the alkaloid in neutral combination with an organic acid. This extract was of a reddish colour when concentrated, and some soft resin was separated by treatment with water; the aqueous solution evaporated spontaneously fell into a mass of crystals exhibiting right-angled ramifications. On adding neutral acetate of lead to some of the solution, nearly all the colouring matter was removed as an orange precipitate, and an almost pure solution of the acetate of the alkaloid was left in the filtrate.

The organic acid, presumably the colouring agent of the leaves, when liberated from its lead salt by sulphuretted hydrogen, had an acid reaction, was soluble in water and spirit, and gave a dark olive-green colour with ferric chloride. The colouring matter was intensified by the addition of the fixed and volatile alkalies, and was not immediately precipitated by the mineral acids. Its lead salt after gentle ignition left 28·3 per cent. of oxide. I would suggest for this organic body the name of "*Adhatodic Acid,*" after the South Indian name of the plant. The occurrence of this organic acid and the alkaloid in the aqueous solution of the alcoholic extract would indicate their natural existence in a state of combination, so that adhatodate of vasicine has scientific claims to be regarded as the active principle of the leaves of *A. Vasica.* The analysis of the leaves reveals certain principles resembling those found in tobacco, as, for instance, an odorous volatile principle, an alkaloid, but not volatile like nicotine, one or more organic acids, sugar, mucilage, and a large percentage of mineral salts. The leaves of Adhatoda submitted to dry distillation evolved substances similar to tobacco under the same conditions. At first water condensed, and an intolerable odour arose from a yellow oily liquid which followed. Then a brown oily substance came over, associated with the pungent vapour of ammonia; and finally a thick brown semi-crystalline solid was driven from the retort to the condensor. These products were all strongly alkaline. The following table gives the results of the proximate analysis of the leaves:—

Volatile odorous principle	0·20
Chlorophyll, fat, resins, and alkaloid extracted by ether	3·20
Adhatodate of vasicine, resin, and sugar extracted by alcohol	12·50
Gum	3·87
Colouring matter, precipitated by lead	4·83
Other organic matters and salts extracted by water	10·38
Extracted by soda solution	4·72
Residue organic	40·71
,, inorganic	9·59
Moisture and loss	10·00
	100·00

The ash was constituted as follows:—

Soluble in water	23·38
Soluble in acid	75·12
Residue	1·50
	100·00

The portion soluble in water was alkaline, and contained chlorides and sulphates. (*Pharm. Jour.*, April 7th, 1888.)

Commerce.—The dried flowering branches are sold in the shops. Value, Rs. 3½ per maund of 37½ lbs.

RHINACANTHUS COMMUNIS, *Nees.*

Fig.—*Bot. Mag., t.* 325; *Rheede, Hort. Mal. ix., t.* 69.

Hab.—Deccan Peninsula, Ceylon. Cultivated throughout India. The leaves and root.

Vernacular.—Palak-juhi (*Hind.*), Joi-páni (*Beng.*), Gajkarni (*Mar.*), Nága-malli (*Tam.*), Nágamalle (*Tel.*), Puzhuk-kolli, Pushpa-kedal (*Mal.*), Nága-mallige (*Can.*), Gachkaran (*Guz.*).

History, Uses, &c.—Indian works on Materia Medica give various prescriptions for the use of the juice of the leaves, and the root bark of this plant as a remedy for the affection of the skin known to Europeans in India as Dhobie's itch, Malabar itch, &c. (*Tinea circinata tropica.*) Whichever part of the plant may be used, it is directed to be made into a paste with lime juice or with aromatics, and applied for several successive days to the affected place. Native testimony in favour of its efficacy is very strong. (Confer. *Makhzan-el-Adwiya,* article "*Palak-Juhi.*") Ainslie, speaking of the *Justicia nasuta,* Linn., says:—"This root fresh, when bruised and mixed with lime juice, is considered as a sovereign application for ringworms and other cutaneous affections; the leaves are also employed for the same purposes. The plant is the *Pulcolli,* also *Peelcolli,* of the *Hort. Mal.* (IX., p. 135, t. 69). I have taken the liberty of giving it the English name of Nagamullie, by which it is universally known in Lower India." (*Mat. Ind.,* II., p. 216.) Roxburgh in his *Flora Indica* (I., p. 121) states that besides its use as a remedy for ringworm, milk boiled on the roots is reckoned by the Indian physicians aphrodisiacal; the roots, he also says, are used for the bite of poisonous snakes, hence the Telinga and Tamul name Naga-mulli, or Jasmine of the Cobra-di-capello. *R. communis* is very common in gardens and grows wild upon the Western Ghauts. Roxburgh gives Yúthikaparni as the Sanskrit name, but this name is applied by

Hindu writers to a kind of Jasmine. Latterly, under the name of *Tong-pang-chong*, Rhinacanthus has found considerable favour in Europe as a remedy for chronic eczema and some other skin affections of a similar character. An extract of the plant appears to be the best preparation.

Description.—A thin shrub, about 5 feet in height. Root woody, ramous; stems many, erect, ramous, the old woody parts round, and covered with pretty smooth, ash-coloured bark, the tender branches and young shoots jointed, smooth, and obscurely 6-sided; leaves opposite, petioled, broad-lanceolate, point obtuse, above smooth, below a little downy, entire, from 2 to 4 inches long and from 1 to 2 broad; panicles corymbiform, axillary, and terminal, always 3-cleft, as also the sub-divisions; peduncles and pedicels short, round, a little downy; bracts minute; flowers small, white; corol with a long, slender compressed tube, under lip broad, 3-cleft, upper lip erect, linear sides reflected, apex bifid; nectary, a fleshy ring surrounding the base of the germ; anthers without the tube, twin. (*Roxb.*) The leaves when chewed have a pungent taste something like cassia bark; their odour when crushed is disagreeable.

Chemical composition.—Liborius has analysed the root in the Dorpat Laboratory, finding in it 13·51 per cent. of ash and 1·87 per cent. of *Rhinacanthin*, a quinone-like body, besides the ordinary constituents of plants.

Rhinacanthin is a dull cherry-red resinous substance, which contains no nitrogen, and does not reduce copper solution. It seems to be related to chrysophanic and frangulic acids. Two ultimate analyses gave a mean of carbon 67·55 per cent., hydrogen 7·36 per cent. The formula $C^{14}H^{18}O^{4}$ corresponds with 67·20 C and 7·20 H. Its presence in the plant is said to be limited to certain intercellular spaces occurring in the bark, the cellular tissue of this part appearing to be filled with an intensely red substance, supposed to consist of a compound of rhinacanthin with an alkali. It is obtained by exhaustion of the powdered root fibres with absolute alcohol. Rhinacanthin has the peculiarity of forming with bases beautiful red compounds that are easily decomposed by certain neutral solvents, such as petroleum spirit, which dissolves the rhinacanthin and assumes a yellow colour. (*Pharm. Zeitch. f. Russl.*, Feb. 1881; *Year Book of Pharm.*, 1881, p. 197.)

VERBENACEÆ.

LIPPIA NODIFLORA, *Rich.*

Fig.—*Wight Ill.*, *t.* 173 *b*, *fig.* 2, and *Ic.*, *t.* 1463; *Sibth. Fl. Gr.*, *t.* 553; *Lam. Ill.*, *t.* 17.

Hab.—Throughout India and Ceylon. The herb.

Vernacular.—Bukkan (*Hind.*), Bhúi-okra (*Beng.*), Ratolia, Vakkan (*Mar.*), Ratavalio (*Guz.*), Podútalai (*Tam.*), Bokenakú (*Tel.*).

History, Uses, &c.—According to Ainslie, the Sanskrit name is Vaśira, but the Nighantas do not mention any plant bearing this name. वशिर, with the synonym of Vasuka occurs, however, in Sanskrit literature, as the name of a plant. *L. nodiflora* is considered by the Hindus to be febrifuge and diuretic, and is administered in gonorrhœa combined with cumin seed. Locally it is applied in the form of paste to promote suppuration. The author of the *Makhzan-el-Adwiya* describes it under the name of *Bukkan* as hot and dry; he states that an infusion is useful in the febrile stage of colds, and that it is diuretic and useful in lithiasis. A poultice composed of the fresh plant is a good maturant for boils.

Ainslie has the following notice of it: "The tender stalks and leaves, which are in a slight degree bitter, the native practitioners prescribe, when toasted, in infusion, in cases of children's indigestions, to the extent of two ounces twice daily; it is also sometimes ordered as a drink for women after lying-in. The plant is a native of Southern Italy and Sicily, as well as India, and has at different times had very different appellations bestowed on it, it being the *Blairia nodiflora* of Gærtner, the *Zapania nodiflora* of Lamarck, and the *Vervena capitata* of Forskahl. The stem is herbaceous, creeping, from 3 inches to a foot in length, sub-divided, rounded, marked with lines, and smooth. The spike is terminating, roundish, composed of small whitish or rose-coloured flowers; it has two seeds, roundish, flatter on one side than the other." (*Materia Indica,* Vol. II., p. 313.)

VERBENA OFFICINALIS, *Linn.*

Fig.—*Hayne Pl. Off.* 5, *t.* 42; *Sweet Brit. Fl. Gard. iii., t.* 202. Vervain (*Eng.*), Verveine, Herbe sacrée (*Fr.*).

Hab.—Himalaya, Bengal Plain, and Persia. The herb.

Vernacular.—Pámúkh (*Hind.*), Fáristariun or Báristariun (*Ind. Bazars*).

History, Uses, &c.—Vervain is the περιστερεών or περιστέριον of the Greeks; the word signifies "a dovecote," and the plant was so named because doves were supposed to be particularly fond of it. It was also called ἱεροβοτάνη or "holy wort," because it was used in sacrifices, purifications, and as an amulet. Dioscorides states that the leaves of the Verbena have a reputation as a local sedative and vulnerary. Pliny (25, 59) says:—"Among the Romans there is no plant that enjoys a more extended renown than *Hierabotane,* known to some persons as *Peristerion,* and among us more generally as *Verbenaca.* It is this plant that we have already mentioned (22, 3) as being borne in the hands of envoys when treating with the enemy, with this that the temple of Jupiter is cleansed, with this that houses are purified and due expiation made. There are two varieties of it: the one, that is thickly covered with leaves (*V. supina*) is thought to be the female plant; that with fewer leaves (*V. officinalis*), the male." Pliny then notices the ridiculous superstitions of the Magi in reference to the plant, and remarks that the plant bruised in wine is used as a remedy for the stings of serpents. De Gubernatis states that Verbena was held in much the same estimation among the Romans as Kusa grass and the Tulasi plant among the Hindus. It bore numerous synonyms, such as Tears of Isis, Tears of Juno, Mercury's Blood, Demetria, Cerealis, &c. In the Middle Ages Verbena was held in high estimation by the Christian priesthood. Piperno (*De Magicis Affectibus*, Napoli, 1635) states, on the authority of Savonarola, that "Verbena manducata non permittit per septem dies coitum" It was considered to be a purifying herb which enforced chastity. In Sicily it is used as a charm to cure diseases at the present day along with fennel. The following is the prayer used in curing polypus with it:—

Zittu, Lucia, non lacrimari,
Scinni ni lu me ortu (come into my garden)
Scippa pampini di brivina e finocchiu
(Gather the leaves of Verbena and fennel)
Ccu li to mano la chiantasti (thou hast planted it),
Ccu li to pedi la scarpisast (thou hast trodden upon it);
La testa di lu purpu (polypus) oci scacciasti,
S'iddu è sangu sfissira (will melt away)
S'iddu è purpu à mori va.

The exorciser then makes three signs of the cross on the polypus with a clove of garlic. In some parts of Piedmont the people believe that rubbing the palm of the hand at sunset with Verbena will ensure the goodwill of the first person whose hand they grasp.

In England Vervain (ferfaen) was used by the Druids in their sacred rites, and was gathered by them with much the same ceremonies as the mistletoe. In Egypt it was sacred to Isis. In Europe it has been extolled as a remedy for most diseases, but is now generally considered to have only slight febrifuge and astringent properties. Quite recently G. Ricci (*Lo Sperimentale*, 1890, Vol. LXVI., p. 483) has again drawn attention to the plant, which he states has febrifuge properties. The root is still sometimes worn as a necklace against the king's evil by the peasantry.

Mahometan physicians describe Verbena under the Arabic name of Rai-el-hamám (رعي الحمام) or as Fáristariun or Báristariun corruptions of the Greek περιστέριον. They state that it is tonic and astringent, useful in paralysis and amenorrhœa, and that a plaster of the leaves promotes the healing of wounds. An ointment is recommended for swellings of the womb, and a vinegar in skin diseases. In Persia it is called Gao-mashang and Div-mashang "fairies pea." According to Stewart, it is used as a tonic and febrifuge in the Punjab. In Cochin-China it is known as *Co-roi-ngua*, and is considered useful in nervous complaints and as a deobstruent in dropsy. (*Loureiro, Flor. Coch. Chin. i.*, p. 27.)

Callicarpa lanata, *Linn., Bedd. Anal. Pl.* 21, *f.* 6; *Wight Ill., t.* 173 *b, f.* 5, and *Ic., t.* 1480; *Rheede, Hort. Mal. iv., t.* 60, is a tree of the Deccan Peninsula, the Circars, and Ceylon, which, though not noticed by Sanskrit medical writers, has a popular reputation on account of its mucilaginous and emollient properties. It is also subaromatic and bitter. Rheede states that the leaves boiled in milk are used as a wash for aphthæ of the mouth, and that the bark and root boiled in water yield a decoction which is used to lessen febrile heat and remove hepatic obstruction and herpetic eruptions. Ainslie records the use of the plant as an emollient by the Javanese and as a diuretic by the Malays. Dr. G. Watt (*Dict. Econ. Prod. Ind.*) on the authority of Dr. Trimen, states that the leaves, roots, and bark are used by the natives of Ceylon in skin diseases. *C. lanata* is from 20 to 40 feet in height, the young branches are cinnamoneous, shaggy and woolly, the leaves 4 to 8 inches long, ovate lanceolate, stellately tomentose beneath; if the tomentum is removed, numerous oil glands are visible. Both leaves and bark are faintly aromatic and bitterish, and afford much mucilage when boiled. The vernacular names are Bastra (*Hind.*), Masandari (*Beng.*), Koat-komal (*Tam.*), Iswar, Meras, Tondi-karavati (*Mar.*), Tondi-teragam (*Mal.*). Rheede states that the Portuguese call the plant *Folhas da raspa Macho*, and the Dutch *Groot Rijf-blad.*

TECTONA GRANDIS, *Linn. f.*

Fig.—*Roxb. Cor. Pl.* 1, 10, *t.* 6; *Brand For. Fl.*, 354, *t.* 44; *Bedd. Fl. Sylv.*, *t.* 250; *Rheede Hort. Mal. ix.*, *t.* 27. Teak tree (*Eng.*).

Hab.—W. Deccan Peninsula, Central India, Burmah. The wood, fruit, and tar.

Vernacular.—Sagún (*Hind.*), Segun (*Beng.*), Ság, Ságwán (*Mar.*), Tekku-maram (*Tam.*), Teku-mánu (*Tel.*), Tegu (*Can.*), Ságach (*Guz.*).

History, Uses, &c.—The teak tree is the Sáka of Sanskrit writers and the Sáj of Arabic and Persian books on Indian Materia Medica. The natives recommend a plaster of the powdered wood in bilious headaches and for the dispersion of inflammatory swellings; taken internally in doses of 90 to 200 grains it is said to be beneficial in dyspepsia with burning pain in the stomach arising from an overflow of bile, also as a vermifuge. The charred wood quenched in Poppy juice* and reduced to a smooth paste is applied to swellings of the eyelids, and is thought to strengthen the sight. The bark is used as an astringent, and the oil of the nuts, which is thick and has an agreeable odour, is used for making the hair grow and removing itchiness of the skin. (*Makhzan-el-Adwiya*, article "Sáj.") Rheede states that from the young leaves a purple dye is prepared. This colour is due to the reaction of alkalies upon a crimson body, soluble in ether, which is contained in the leaves; it forms soluble compounds with lead and baryta.

Endlicher states that the flowers are diuretic; this is confirmed by Gibson, who says that the seeds have a similar property; in two cases he saw marked diuresis follow the application of an epithem of the bruised fruit to the pubes. In the *Pharmacopœia*

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* The word used in the Makhzan is *Mámitha*, an Arabic name for the Argemone of the Greeks and Romans. Two kinds of Mámitha are described by Arabic and Persian writers—one with red flowers, the other with yellow. (Conf. Dios. ii., 168, 169.) In India *Argemone mexicana* is used for Mámitha.

of India a paste made from the powdered wood is said to allay the pain and inflammation caused by handling the Burmese black varnish which is obtained from *Melanorrhœa usitatissima.* Col. Burney (*Journ. Asiat. Soc. of Bengal,* Vol. I., p. 170) has published some interesting remarks on its use. A tar is extracted from the wood, which is used as an application to the sores of draught cattle to prevent maggots breeding. As a rule white-ants will not touch teakwood, and the use of teakwood tar has been suggested as a remedy against these destructive pests. The wood is also not easily affected when exposed to damp weather, and baskets for holding orchids are commonly made of teak in Burmah; while orchids are also preferably mounted on teak blocks.

At a meeting of the Nilgiri Natural History Society in 1887, Mr. Lawson showed a specimen of a whitish mineral substance found in a teak tree growing in the Government Plantation at Nilambúr. This peculiar secretion is not altogether unknown to officers in the Forest Department, and its composition has on more than one occasion been investigated by chemists.

In 1870 the fact of calcareous masses occurring in timber was brought to the notice of the Asiatic Society of Bengal by Mr. R. V. Stoney, who stated (*vide* P. A. S. B., May 1870, p. 135) that many trees in Orissa had pieces of limestone or calcareous tufa in their fissures, but principally Asan (*Terminalia tomentosa,* W. and A.), Swarm (*Zizyphus rugosa,* Lam.), Sissu (*Dalbergia Sissu,* Roxb.), and Abnus (*Diospyros melanoxylon,* Roxb.).

In 1880 Mr. V. Ball, in making a geological survey in the Central Provinces, met with this concretion, and thus alludes to it in his "*Jungle Life in India*": "Some white marks on the cut stumps of an Asan tree caught my eye, and these on examination proved to be sections or laminæ of calcareous matter which alternated with the ordinary rings of woody growth. The rocks about were gneisses and schists, and I could discover nothing in the soil to account for the peculiarity. In some cases irregularly shaped pieces seven inches long by two inches thick were met in the trunks at a height of about six feet from the ground. By the natives the lime is burnt and used for chewing with *pan.* On examination it was found there was no structure in these masses, which would justify a conclusion that they had been formed by insects. Some included portions of decayed wood and seemed to be cemented together by the lime."

. Major-General Morgan, late Deputy Conservator of Forests, Madras, speaks of it in the following terms in his "*Forestry of Southern India*": "It is a curious fact that in the Wynaad though there is no free lime in the soil, yet Teak (*Tectona grandis*) and Blackwood (*Dalbergia latifolia*), if wounded near the ground, contrive to absorb large quantities of lime. It may be seen encrusting the tree on the surface as far as four feet in height, from three inches to a foot in width, and two or three inches in thickness. The lime is so hard that it destroys circular saws, and the Carumburs use it for chewing with betel."

Description.—Trunk erect, growing to an immense size; bark ash-coloured and scaly; branches numerous, spreading; young shoots 4-sided, sides channelled; leaves opposite, petioled, spreading, oval, a little scalloped, above scabrous, below covered with whitish rather soft down, they are larger at a distance from the flowers, and on young trees, *viz.*, from 12 to 24 inches long and from 8 to 16 broad; petioles short, thick, laterally compressed; panicles terminal, very large, cross-armed, divisions dichotomous, with a sessile fertile flower in each cleft, the whole covered with a hoary, farinaceous substance; peduncles common, quadrangular, sides deeply channelled, angles obtuse; bracts opposite, lanceolate, two at each sub-division; flowers small, white, very numerous; calyx and corolla oftener six than five cleft; nectary very small, frequently wanting, stamens often six; germ superior, round, hairy, 4-celled, with one ovule in each attached to the axis; stigma 2-cleft, divided, obtuse, spreading; drupe within the enlarged, inflated, dry calyx obtusely 4-sided, woolly, spongy dry; nut exceedingly hard, 4-celled. (*Roxb.*) The wood has a peculiar aromatic odour. The tar obtained from it is black and opaque when properly made, but when prepared from partly dried wood it is mixed with the sap and forms a greyish brown emulsion. The seeds are of the size and shape of Sesamum seeds; they are very oily, but the difficulty of extracting them from the nuts would make the oil very expensive; it is a bland, fatty oil, free from any peculiar odour.

Chemical composition.—Abel in 1854 showed that the wood of teak frequently exhibits cracks and cavities of considerable extent lined with a white crystalline deposit consisting chiefly of hydrocalcic orthophosphate, $Ca\,H\,PO_4$, H_2O, with about 11·4 per cent. ammonio-magnesium phosphate. (*Chem. Soc. Qu. J. xv.*, 91.)

This white deposit in the wood of teak has also been examined by Thoms, who found it to consist of monocalcic orthophosphate $Ca\,H\,PO_4$ (*Landw. Versuchs. St.* xxii., 68; xxiii., 413.) More recently still Professor Judd has found in teak a specimen of crystalline apatite, a well-known mineral containing a large proportion of calcium phosphate.

"The formation of this deposit indicates that the wood itself must contain a considerable quantity of phosphoric acid, and the analysis shows this is really the case, as the ash of teakwood is composed as follows:—

CaO	MgO	FeO	K_2O	Na_2O	SiO_2	SO_3	P_2O_5	CO_2	Cl
31·35	9·74	0·80	1·47	0·04	24·98	2·22	29·69	0·01	0·01

The percentage of carbon and hydrogen are higher than in most woods, and this, together with the richness in calcium phosphate and silica, may perhaps account for the great hardness of teak." (*Watts' Dict. Chemistry, 3rd Suppl.*, p. 1894.)

Mr. D. Hooper says:—"The sample from Nilambúr was in the form of a rounded flattened cake about ten inches in diameter and two or three inches in thickness; dirty white in colour, with a rough gritty surface. A sample was made for analysis by breaking off portions from different parts of the cake and reducing the whole to a fine powder. The powder examined under the microscope was mainly in an amorphous condition similar to prepared chalk, with a dark-coloured gummy matter, and a small quantity of crystalline quartz sand. The following is the composition:—

Calcium carbonate	70·05
Tricalcic orthophosphate	2·89
Quartz sand	9·76
Organic matter	14·30
Moisture	3·00
	100·00

The analysis shows that the principal compound is calcium carbonate, and the concretion approaches nearer the chalk or limestone formation than that of the apatite or phosphatic found by other investigators. An examination of deposits from other trees might show greater differences than these, but it seems enough has been done to prove that the calcium element forms the base.

The sand, probably blown up as dust and made to adhere by the organic matter, is a mechanical ingredient. The deposit contained no salts of sodium or calcium soluble in water, nor any ammoniacal compounds; this would stand to reason, as the heavy rains to which this district is subjected would scarcely leave anything soluble on the trees.

The scanty amount of lime present in the soil, and the large amount found in the tree, show what an enormous quantity must have been taken up by the sap. I have shown elsewhere that a full-sized cinchona tree contains about 10 ounces of lime (as slaked lime), not concentrated by abnormal development in one place, but distributed in all its parts. A teak tree from its size and ash contents would have a much larger supply than a cinchona, and yet, it seems, is able to excrete it in some abundance. In what manner this takes place is not easy to determine. The calcium enters the plant in a soluble form as sulphate. The calcium unites with oxalic and other acids and is precipitated, while the sulphuric acid parts with its sulphur to form organic compounds. A wound in the tree is liable to render these processes abnormal by causing the vegetable acids to ferment by exposure to the air and to yield carbonic acid as one of the products, and this meeting with the calcium in the ascending sap exuding from the wound might convert it into an insoluble calcium carbonate which would harden in the cavity of the tree and form the deposit." (*A paper read at a Meeting of the Nilgiri Natural History Society, Ootacamund, November 7th,* 1887.)

Teak wood yields on distillation with water an opalescent distillate impregnated with resinous matter, but no trace of essential oil could be obtained when operating with 126 lbs. of fresh sawdust from Indian teak. For the extraction of the tar two earthen pots were used luted together; the upper with a perforated bottom contained the wood in chips; the product was a rather liquid black tar having much the odour of coal tar. One pound of the sawdust exhausted with alcohol yielded a resinous extract, which, after having been well washed with hot water, weighed half an ounce; the resin is black, and has the peculiar odour of the wood.

The late R. Romanis (*Jn. Chem. Soc.*, 3-11-87) found that alcohol extracts a soft resin from teak wood, but no oil or varnish. On distilling the resin he obtained a crystalline substance which he also found to be present in considerable quantity in the tar resulting from the destructive distillation of teak. The analyses which he has made of the crystals point to the empirical formula $C^9 H^{10} O$; on oxidation with nitric acid they yield what appears to be a quinone of the formula $C^{18}H^{16}O^2$.

PREMNA INTEGRIFOLIA, *Linn.*

Fig.—*Wight Ic., t.* 1469; *Rumph. Herb. Amb. iii., t.* 134.

Hab.—Coasts of India from Bombay to Malacca, Silhet, and Ceylon. The leaves and root.

Vernacular.—Arani, Ganiari (*Hind.*), Bhut-bhiravi (*Beng.*), Munni (*Tam.*), Ghebu-nelli, Pinna-nelli (*Tel.*), Arani (*Mar.*), Takkilé, Taggi (*Can.*), Mothi-arani (*Guz.*).

History, Uses, &c.—This shrub, in Sanskrit Arani, Harimantha, Agni-mantha, and Vahnimantha, "producing fire by friction," is so named on account of its wood being one of those used to obtain the sacred fire. Gamble states that in Sikkim the hill tribes habitually make use of the wood of *P. latifolia* and *P. mucronata* for obtaining fire. Of the two pieces of wood used by the Hindus for this purpose, the lower or soft wood is called in Sanskrit Adharárani, and the upper or hard wood, with which friction is made, is called the Pramantha; they are considered to be symbolical of the Yoni and Upastha (organs of generation).

In the Nighantas Arani is described as hot, an expellant of phlegm and wind.

Its root is one of the ingredients of the Dasamula, and the leaves are a popular remedy in the exanthematous fevers. Ainslie states that the root has a warm bitter taste and agreeable smell, and is prescribed in decoction as a gentle cordial and stomachic in fevers. Rheede calls the plant *Appel,* and notices the use of a decoction of the leaves for flatulence. Ainslie also remarks that it is the *Folium hirci* of Rumphius and that Burman calls it *Cornutia corymbosa* and Herman *Sambucus odorata aromatica.* In Ceylon it is known as *Maha-midi* or *Midi-gass.* Atkinson states that the leaves rubbed with pepper are administered in colds and fevers, and that externally a decoction of the whole plant is used in rheumatism and neuralgia.

Description.—A large shrub or small tree, blossoming in the rainy season. Trunk short; branches numerous, often procumbent and rooting; bark smooth, dark brown, leaves opposite, petioled, cordate, serrate on the anterior margins, acute pointed, smooth on both sides, from 1 to 6 inches long and from 1 to 3 inches broad; flowers in corymbs, terminal or between two branchlets, primary divisions opposite, the last 2-forked, flowers minute, numerous, of a pale greenish-white; berries black, the size of a pea. The plant has an agreeable aromatic odour and an acidulous and astringent taste.

Chemical composition.—The root-bark of this plant afforded a yellowish-brown powder giving an orange-brown tincture with alcohol. The tincture when evaporated left a reddish-coloured tasteless resin and some extractive matter. The resin was soluble in ether and in alkaline liquors; from the latter solution it was precipitated in greyish-brown flocks by acids. Warmed with soda, the resin evolved an odour of lemon similar to that of Kamala resin; heated with sulphuric acid a transient purple colour was developed and a fragrant odour evolved. It showed no disposition to crystallize. The watery solution of the alcoholic extract had a sweetish taste in small quantities and was nauseous in larger quantities. It contained a bitterish amorphous alkaloid, a substance reducing Fehling's solution, and an astringent body, striking a green colour with ferric chloride, but giving no precipitates with gelatine. The alkaloid gave no distinct colour reactions with the strong mineral acids.

PREMNA HERBACEA, *Roxb.*

Fig.—*Griff. Ic., t.* 447, *lower figure*; *Ferguson, Pamphl.,* Colombo, 1887.

Hab.—Sub-tropical Himalaya and South Deccan Peninsula. The root.

Vernacular.—Bhárangi (*Hind.*), Bámanháti (*Beng.*), Shirutek (*Tam.*), Gandu-bárangi (*Tel.*), Bháranga-múla (*Mar.*), Gantu-bhárangi, Náyityága (*Can.*), Kanta-bháranni (*Mal.*), Barang (*Guz.*).

History, Uses, &c.—This plant is frequently confounded with *Clerodendron serratum*, Spreng., the roots and stems of which are sold under the name of Bhárangi. In Sanskrit Bhárangi bears the names of Bhárgi, Brahmayashtika, Hangika, Bringa-ja, and Vardhaka, and is described in the Nighantas as hot, bitter, pungent, and digestive; a remover of dropsy, cough, phlegm, asthma, fever, and rheumatism. The juice of the root is given with the juice of ginger and warm water in asthma, and it enters into the composition of several compound decoctions for diseases of the lungs. A confection called *Bhárgi-guda* is prepared with a decoction of the root, and the ten drugs called *Dasamula,* chebulic myrobalans, treacle, and aromatics. An oil prepared with the root is recommended for external application in the marasmus of children. (*Chakradatta.*)

The properties of *P. herbacea* agree much more nearly with those attributed to Bhárangi in the Nighantas, than do those of *Clerodendron serratum,* although the latter plant is at the present time in use as Bhárangi throughout the greater part of India. Dutt attributes the drug to *C. Siphonanthus,* but the samples we obtained from Bengal consisted of the stems of *C. serratum.* Bombay was formerly supplied from the Circars with *P. herbacea,* but now uses *C. serratum.* Although the root of *P. herbacea* has been known from ancient times, it is only within the last few years that its botanical origin has been identified. It was exhibited at the Madras Exhibition of 1855, under the name of Gantu Bhárangi, among several chemical and pharmaceutical products. It is mentioned in Sir Walter Elliot's *Flora Andhrica,* published in 1859, and referred to an unknown species of Clerodendron, which, he says, might be called *acaulis;* the plant is there said to grow about Lammasingi to the west of Vizagapatam, whence it is exported to Madras and Bombay to the amount of several thousand rupees yearly.

W. Ferguson in 1861 identified the Gantu Bhárangi of Southern India with *P. herbacea,* and in a pamphlet published at Colombo in 1887 gave a figure of the plant and its root.

Description.—A small undershrub; flowering branches 1—4 inches, springing up after the jungle fires. Leaves 4 by 2—3 inches, obtuse, mature microscopically dotted above, minutely deciduously pubescent beneath, nerves 5 pair. Corymbs 1½ inch in diameter, pubescent, somewhat dense; peduncle 0—1½ inch. Calyx $\frac{1}{10}$ inch, closely pubescent; lobes ovate, obtuse. Corolla ⅛ inch, greenish-white, hairy in the throat, 4-lobed, obscurely 2-lipped. Drupe ¼ inch in diameter, globose. Roots about as thick as a crowquill with numerous almost globular woody knots.

Chemical composition.—The constituents of this root resemble to a great extent those found in *P. integrifolia.* An orange-brown acid resin soluble in ether, alcohol and alkaline solutions, and traces of an alkaloid are the most important. There is a quantity of starch in the root, and an entire absence of astringency.

Premna tomentosa, *Willd., Wight Ic., t.* 1468, Naguru-chettu (*Tel.*), Pedanganeree, Kollay-cottaynellay (*Tam.*), is used medicinally in Southern India. Dr. P. S. Mootooswamy states that the leaves are diuretic, and are given internally and applied externally in dropsy. An infusion of 10 drachms of the leaves and 2 drachms of coriander in ten ounces of boiling water has been used by him with advantage in acute dropsies.

Dr. Mootooswamy has seen the natives using the leaves soaked in goat's urine or in onion juice for dropsy; sometimes chebulic myrobalans are added if the bowels are costive.

GMELINA ARBOREA, *Linn.*

Fig.—*Roxb. Cor. Pl. iii., t.* 246; *Wight Ic., t.* 1470; *Bedd. Fl. Sylv., t.* 253; *Rheede, Hort. Mal. i., t.* 41.

Hab.—Deccan Peninsula, and Ceylon to N.-W. Himalaya. The root and fruit.

Vernacular.—Kambhári, Gumhár, Shevan (*Hind.*), Gámári (*Beng.*), Shivani, Shevana (*Mar.*), Shivannigida (*Can.*), Gumadi (*Tam.*), Gumar-tek, Peddagomru (*Tel.*), Kumbulu (*Mal.*), Shewan (*Guz.*).

History, Uses, &c.—In the Nighantas this tree bears the Sanskrit names of Ghambhári, Sriparni, Kásmari, &c. The root is described as bitter, tonic, stomachic, laxative, and useful in fever, indigestion, anasarca, &c. It is an ingredient of the Dasamula, or "ten roots," and is therefore much used in a variety of diseases. Bangasena says that Gambhári root taken with liquorice, honey, and sugar increases the secretion of milk. The fruit is bitter-sweet and cooling, and enters into the composition of several cooling decoctions which are recommended for fever.

The following is an example: Take of the fruits of *G. arborea* and *Grewia asiatica* (parushaka), liquorice root, red sandal wood, and the root of *Andropogon muricatus* (ushira), equal parts, in all two tolás (360 grains), water thirty-two tolás, and boil till reduced to one half. (*Chakradatta,* quoted by Dutt, *Hind. Mat. Med.,* p. 218). The juice of the young leaves is used as a demulcent in gonorrhœa, cough, &c., alone or with other demulcents (*Pharmacopœia of India,* p. 164). The bark of the tree is used by arrack manufacturers in the Madura district to regulate the fermentation of toddy.

The wood of this tree on account of its lightness and toughness is much valued for carriage-building and all ornamental work; it is light yellow with a reddish heart wood, close and even-grained, easily worked, and readily takes paint or varnish. At the Government Medical Store Depôt Workshops it has been found to be the best wood for making artificial limbs, stethescopes, &c. It turns well. Weight 30 to 40 lbs. per cubic foot.

Description.—An unarmed tree, sometimes attaining 60 feet, deciduous, flowering with the young leaves. Leaves 9 by 6 inches, more or less acuminate, entire, mature glabrate above, stellately hairy beneath; petiole 3 inches, top glandular. Panicles often one foot in length, terminal; bracts ⅛ inch; flowers numerous. Calyx ⅙ inch, teeth very small or obsolete. Corolla brownish-yellow, upper lip shortly bifid, longer than the lower. Drupe ¾ inch, ovoid, usually 2 to 1 seeded. The roots have a light brown bark and yellowish wood, which is light and tough; they have a bitterish mucilaginous taste. The fruit is bitter-sweet and mucilaginous.

Chemical composition.—The root reduced to fine powder lost 8·39 per cent. at 100°C. The ash amounted to 14·41 per cent., and was free from any trace of manganese.

On analysis the following results were obtained :—

Petroleum ether extract	...... 1·80	per cent.
Ether ,,	...... ·21	,, ,,
Alcoholic ,,	...... 4·274	,, ,,
Aqueous ,,	... 19·560	,, ,,

The petroleum ether extract consisted of a yellow viscid oil, with slight siccative properties. On standing, white grains separated, which were non-crystalline when examined microscopically. In alcohol the extract was partly soluble: no alkaloid was present. The ether extract was yellowish-white, and contained a trace of oil; it gave no reaction with ferric salts: in addition to resins a trace of benzoic acid was present.

The alcoholic extract was yellow and brittle: with water a turbid mixture was obtained, which had a bitter taste. In addition to resins a trace of an alkaloidal principle was detected.

The aqueous extract was sweetish and slightly bitter, and easily reduced Fehling's solution on boiling.

The fruit contained butyric acid, with a trace of tartaric acid, a trace of astringent matter giving a greenish coloration with ferric chloride, an alkaloid, and a white principle, non-crystalline, and neutral, with resin and saccharine matter.

The alkaloids present in the fruit and in the root appear to be identical. The amount present in each case was very small, not exceeding a trace.

Several species of Gmelina are sometimes used as demulcents.

G. asiatica affords the *Radix Deiparæ* or *Rais madre de Deos* of the Portuguese. Rumphius (*Hort. Amb.*, i., p. 129) relates that formerly its roots were dug only on St. Mary's day, and that only those roots which turned towards the north were selected for use. It was in great request in Goa as an antidote to every poison, and a remedy for every disease in former days. The roots are slightly bitter, astringent, and aromatic. Loureiro says:—" Valent in doloribus articulorum, et affectibus nervorum, radix interne sumpta; folia externe applicata." (*Flor. Cochin-Chin.*, ii., p. 376.) The Tamil name is *Nilaváimal*, and the Telugu *Nela-gúmudi*. (*Ainslie*, *Mat. Ind.*, ii., p. 240.)

VITEX NEGUNDO, *Linn.*

Fig.—*Wight Ic.*, *t.* 519; *Rheede, Hort. Mal. ii.*, *t.* 12.

VITEX TRIFOLIA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 2187; *Rheede, Hort. Mal. ii.*, *t.* 11.

Hab.—Throughout India and Ceylon. The leaves, root, and fruit.

Vernacular.—Sambhálu, Nisinda (*Hind.*), Nisinda (*Beng.*), Vanai, Nigudi, Lingur (*Mar.*), Vellai-nochi, Nir-nochi (*Tam.*), Tella-vávili, Niru-vávili (*Tel.*), Nochi, Nirnochi (*Mal.*), Lakki, Karé-lakki (*Can.*), Niguri (*Guz.*).

History, Uses, &c.—These two shrubs, the properties of which appear to be identical, are described by Sanskrit writers under the names of Nirgundi, Sindhuvára,* Sephálika, Svetapushpi, Pushpanílika, &c. Two varieties are recognised: one with pale blue flowers (*Svetapushpi*), and the other with blue flowers (*Pushpanílika*). Among the Tamils, one of these plants is supposed to be male and the other female, and for this reason they are usually combined together in their prescriptions. In the Nighantas, Nirgundi is described as cephalic, pungent, astringent, bitter and light; a remedy for colic, swellings, rheumatism, worms, leprosy, dyspepsia, phlegm, and boils.

The leaves are generally used as a discutient fomentation in sprains, rheumatism, swelled testicles, contusions, &c. The root is thought to be tonic, febrifuge, and expectorant, and the fruit nervine, cephalic, and emmenagogue.

Mahometan physicians use these plants as substitutes for *Vitex Agnus-castus*, the fruit of which is imported into India and sold in the bazars as Sambhálu-ke-bij.

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* Sinduka, Sinduvára or Syandavára, from being used to prevent a flow of humours, is probably more correct.

V. Negundo is the Lagondium of Rumphius, who states that the leaves are used to preserve rice and clothes from insects and to drive them away; and that the Javanese women make an extract from it which they use as a carminative and emmenagogue. In India the leaves are often placed between the leaves of books to preserve them from insects.

V. trifolia, Linn., is highly extolled by Bontius. (*Diseases of India*, p. 226.) He speaks of it as anodyne, diuretic, and emmenagogue, and testifies to the value of fomentations and baths prepared with 'this noble herb,' as he terms it, in the treatment of Beri-beri, and in the allied and obscure affection, burning of the feet in natives. Of *V. Negundo*, Fleming remarks (*Asiat. Researches*, Vol. XI.) that its leaves have a better claim to the title of discutient than any other vegetable remedy with which he is acquainted. The mode of application followed by the natives is to put the fresh leaves into an earthen pot and heat them over the fire till they are as hot as can be borne without pain; they are then applied to the affected part, and kept *in situ* by a bandage; the application is repeated three or four times a day until the swelling subsides. Pillows of the dried leaves are sometimes used to lie upon for cold in the head and headache. Dr. Hové (1787) states that the Europeans in Bombay call it the fomentation shrub, and that it is used in the hospitals there as a foment in contractions of the limbs occasioned by the land winds. In the Concan the juice of the leaves with that of Máká (*Eclipta alba*) and Tulasi (*Ocimum sanctum*) is extracted, and Ajwán seeds are bruised and steeped in it, and given in doses of six *massas* for rheumatism. The juice in half tolá doses with ghi and black pepper is also given, and in splenic enlargement 2 tolás of the juice with 2 tolás of cow's urine is given every morning. A very interesting account of the treatment of febrile, catarrhal, and rheumatic affections, as practised by the people of Mysore, by means of a sort of rude vapour bath prepared with this plant, is furnished by Dr. W. Ingledew. (*Edin. Med. and Surg. Journ.*, Oct. 1817, p. 530.) Roxburgh mentions the use of baths prepared with the aromatic leaves in the puerperal state of women in India. According to Ainslie, the Mahometans are in the habit of smoking the dried leaves in cases of headache and catarrh. The dried fruit is deemed vermifuge. (*Phar. of India*, p. 163.)

Description.—A shrub growing in patches; branchlets, panicle, and underside of the leaves white, with a fine tomentum; leaves petioled, 3 to 5 foliolate; leaflets lanceolate, long, acuminated, entire, or coarsely cut and crenated; panicle terminal, pyramidal; flowers bluish-white to blue; berry black, the size of a pea. The habit of the shrub is variable; when growing near the sea it has almost always 3-foliolate entire leaves, the leaflets being attenuated into the petioles; inland, the shrub has a more delicate appearance; the petioles of the leaves are much longer and the leaflets, from 3 to 5 in number, are often serrated. The serrated variety is preferred for medicinal purposes, and is called *Kátri.* The leaves of both varieties appear to be equally aromatic; the odour reminds one of the English Bog Myrtle (*Myrica Gale*, Linn.); the taste is bitter and nauseous. The berry is very feebly aromatic. In Anthony Collin's French Translation of Clusius, Lyons, 1602, there are figures of both plants, which, though old and quaint, represent the general appearance very fairly.

Chemical composition.—The leaves contain principally an essential oil and a resin. The oil possesses the odour of the drug and is neutral and almost colourless. The resin dissolves in alkaline solutions with a reddish-brown colour, softens below 40° C., and gives off aromatic vapours when heated. A tincture of the drug gives a green colour withferric chloride. The ash of the air-dried leaves amounts to 7·75 per cent.

The fruits contain an acid resin, an astringent organic acid giving a green colour with ferric salts and a precipitate with gelatine, malic acid, traces of an alkaloid and colouring matter. The fruits previously dried at 100° gave 6·8 per cent. of ash.

Vitex Agnus-castus, *Linn.* Mahometan physicians, under the Arabic name of Athlak and the Persian Panjangusht, describe the ἄγνος of the Greeks and the Vitex of the Romans. The berries under the names of Hab-el-fakad and Sambhálu-ke-bij are imported into India and are considered to be astringent, resolvent, and deobstruent, and useful for removing obstructions of the brain and liver; they are also given for enlargement of the spleen and dropsy. *V. Agnus-castus* is also called by the Arabs Zu-khamsata aurák, " the five-leaved," and in Egypt is known as Kaf Miryam, " the hand of Mary." Among the ancients it was sacred to Esculapius, and was considered symbolical of chastity. In the Middle Ages the fruit was known as " Monks' pepper." The fruit is sold in Bombay as *Rénuka,* the true rénuka (*Piper aurantiacum*) is not known in Western India.

Description.—A small, dull gray, ovoid fruit, the size of a duckshot, half enclosed in the calyx, to which a portion of the peduncle remains attached. Upon section it is found to be extremely hard, and, if perfect, to consist of four cells, each containing a small flat seed. Generally one or more of the cells are abortive.

Chemical composition.—The seed of *V. Agnus-castus* has been found to contain a peculiar bitter principle called *Castine,* a volatile acrid substance, a large quantity of free acid and fat oil. In Greece the fresh and rather unripe berries are said to be added to the must of the grape to render the wine more intoxicating, and prevent it from turning sour. (*Landerer, Buchn., Repert. liv.,* 20; LXXXI., 229; *Buchn. N. Repert.,* III., 392.)

CLERODENDRON INERME, *Gärtn.*

Fig.—*Gärtn. Fruct. I., t.* 57, *f.* 1; *Rheede, Hort. Mal. v., t.* 49.

Hab.—India and Ceylon, near the sea. The leaves.

Vernacular.—Sangkupi, Chhoti-arni (*Hind.*), Isamdhári (*Dukh.*), Shen-gankuppi (*Tam.*), Pishinika, Utichettu (*Tel.*), Banjoi (*Beng.*), Koivel, Vanajai, Lahán-khári-narvel (*Mar.*), Naitakkilé (*Can.*).

History, Uses, &c.—This is a shrub the medicinal properties of which are widely known in the East. Some identify it with the Kshudrágnimantha of the Rája Nirghanta. It is the *Gambir-laut* of Java, the *Wœl-bu-rœnda* of Ceylon, and the *Sanfu-mun* of Cochin-China. Ainslie says the juice of the leaves and root is considered alterative in scrofulous and venereal affections, the dose being a tablespoonful with or without a little castor oil. Rheede speaks of the use of the dried leaves for the same purpose, and of a poultice of the leaves to resolve buboes; he also says a bath prepared with them is used in mania, while the root boiled in oil affords a liniment useful in rheumatism. *C. inerme* is the *Jasminum litoreum* and *Pharmacum litoreum* of Rumphius (*Lib.* vii., cap. 47), who says the Amboyna name is *Wale-puti-lohaha,* which means "white strand cord." The Malays and Macassars administer the berries or the root to people poisoned by eating unwholesome fish; the leaves smeared with oil are heated over the fire and applied to recent wounds; they are also one of the leaves used for preparing the green rice of the Malays; he concludes by saying "larga ac fausta natura in cunctis fere litoribus hanc obviam profert plantam." In Bombay the plant has a great reputation as a febrifuge; the juice of the leaves is used in doses of half an ounce. It is mucilaginous, very bitter, somewhat saline, and with a fragrant, apple-like odour.

The medicinal properties of *C. inerme* closely resemble those of Chiretta. The dried leaves have been found to be quite as efficient as the juice of the fresh plant; they should be dried in the shade to preserve their aroma, and may be administered in decoction with aromatics, or powdered and made into pills. A tincture has also been found to be an efficient preparation.

Description.—A straggling shrub, 3—7 ft.; shoots grey-pubescent. Leaves opposite, rarely ternate, $\frac{3}{4}$—$1\frac{1}{2}$ in., when young somewhat grey-pubescent, base cuneate; petiole $\frac{1}{8}$ in. Peduncles $\frac{1}{2}$—$1\frac{1}{2}$ in., all axillary, 3—7 fid.; bracts $\frac{1}{30}$ in., linear; pedicels $\frac{1}{8}$—$\frac{1}{6}$ in., calyx grey-puberulous or glabrate. Corolla white, tube $\frac{3}{4}$ in., glabrate, lobes $\frac{1}{3}$ in., oblong. Drupe $\frac{1}{2}$ by $\frac{1}{3}$ in., spongy, hardly succulent, smooth, hardly sulcate, separating into four woody pyrenes. Or the leaves may be mostly ternate or sublinear and larger. The drupe also may vary in size. Some on this account make Rumphius' plant a separate species under the name of *C. neriifolium*, but Bentham and Kurz consider it only a variety.

Chemical composition.— A proximate analysis of the leaves gave the following results:—

Ethereal extract	4·77
Alcoholic „	5·70
Aqueous „	15·54
Alkaline „	11·48
Organic residue	50·06
Inorganic „	6·44
Moisture „	6·01
Total	100·00
Ash soluble in water	44·14
„ „ in acid	47·10
Sand and silicates	8·76
Total	100·00
Sodium chloride in ash	24·01

The bitter principle is entirely removed by ether, and the subsequent treatment by alcohol and water affords extracts which are free from any bitterness. Ether, alcohol, and water independently exhaust the leaves of this principle, but the former removes it with less admixture of foreign substances. The ether extract evaporated and mixed with water will give up the bitter property to the solvent, and this by gradual evaporation leaves it in an almost pure condition. It is obtained as a viscid mass, which, in process of time and by exposure to the air, hardens, and may be reduced to a non-hygroscopic powder. It is soluble in water, with a slightly acid reaction, and is partially rendered insoluble by neutral plumbic acetate, thus giving evidence of its compound nature. The portion precipitated by the lead salt, when liberated from the metal by hydrogen sulphide, was a light-coloured amorphous acid powder, soluble in water, spirits of wine and ether, and reducing Fehling when in aqueous solution. The bitter principle that escaped precipitation by plumbic acetate was readily shaken out of the acid filtrate with ether. This was a whitish amorphous powder soluble in water, with a neutral reaction, and did not reduce Fehling's solution; it was not precipitated by alkalies, and was not coloured with ferric chloride; it was chiefly distinguished by its being precipitated by tannin and affording a transient red-brown colour with strong sulphuric acid. The dual nature of the bitter principle seems to show a very remarkable resemblance with that found in Chiretta (*Swertia Chirata*), a gentianaceous plant. Chiretta has been investigated by Höhn, who found the drug to contain *Ophelic acid* $C^{13} H^{20} O^{10}$ and *Chiratin* $C^{26} H^{48} O^{15}$, an acid and neutral bitter principle respectively, and representing the activity of the herb.

The leaves, when distilled with water, yield a stearopten-like body having the fruity flavour of the fresh plant. The ether extract was fragrant, green, and of a greasy consistence. The alcoholic extract contained some resinous matter, and much of the salt, which was left as cubical crystals when evaporated. Water dissolved out gum and brown colouring matter. Neither tannin nor starch was present in the leaves. They left on gentle incineration as much as 15·29 per cent. of ash, and the large amount of salt in this ash indicates the habitat of the plant as being in close proximity to the sea. (*Hooper in Pharm. Record*, Aug. 1st, 1888.)

CLERODENDRON INFORTUNATUM,
Gärtn.

Fig.—*Rheede, Hort. Mal. ii., t.* 25; *Burm. Zey., t.* 29.

Hab.—Throughout India. The leaves.

Vernacular.—Bhánt (*Hind.*), Bhat (*Beng.*), Chitu (*Nepal*), Bhándir, Kari (*Mar.*), Karé (*Can.*).

History, Uses, &c.—Rheede states that the leaves of this plant are used as a vermifuge, and that the root rubbed down with buttermilk is administered in colic and lientery. Dr. Bholanath Bose has drawn attention to the leaves as a cheap and efficient substitute for Chiretta. (*Pharmacopœia of India.*) Brigade-Surgeon J. H. Thornton considers the expressed juice of the leaves to be an excellent laxative, cholagogue, and anthelmintic; also a valuable bitter tonic, and useful as an injection into the rectum for the destruction of ascarides. These opinions are supported by those of six other medical officers quoted by Dr. G. Watt in the *Dictionary of the Economic Products of India*, ii., p. 373. M. C. Dutt gives Bhândira as the Sanskrit name, but this name does not occur in the Râja Nirghanta, and is usually applied to other plants. In Western India it has been identified with the Kâri of the Râja Nirghanta.

Description.—A gregarious shrub spreading by underground suckers, 3 to 6 feet in height. The leaves are from 8 to 10 inches long, and from 7 to 8 inches broad at the base, ovate-cordate, hairy on both sides, odour disagreeable, taste bitter, and slightly astringent. The inflorescence forms large, terminal, cross-armed panicles, flowers white, streaked with pink, sweet-scented; after they have fallen, the calyxes enlarge and turn red.

Chemical composition.—A proximate analysis of the leaves gave the following result:—

Ethereal extract	10·81
Alcoholic ,,	16·40
Aqueous ,,	15·20
Alkaline ,,	8·97
Organic residue	38·47
Inorganic ,,	5·93
Moisture	4·22
Total	100·00

Ash soluble in water	16·83
,, ,, in acid	72·86
Sand and silicates	10·30
Total	100·00

Sodium chloride in ash .... 5·58

The leaves of *C. infortunatum* were devoid of the odorous principle noticed in the former species, and yielded no volatile constituent when boiled with water. The ether extract contained a quantity of resinous matter, and gave up the bitter principles when heated with water; the extract was of a less fatty consistence than that from the *C. inerme* leaves. The spirituous extract was also much larger than in the previous sample, and was differently constituted, inasmuch as it almost entirely consisted of a tannin, giving a green colour with ferric chloride. These leaves contain much more soluble organic matter than the former, but the percentage composition of the ash shows that the soluble inorganic salts are much smaller. The ash of these leaves amounted to 12·3 per cent. (*Hooper in Pharm. Record,* Aug. 1st, 1888.)

Clerodendron Siphonanthus, *Br., Lam. Ill., t.* 79, *f. i.*; *Wight Ill., t.* 173, is stated by M. C. Dutt to be in use in Bengal as Bhárangi, but the samples of that drug which we obtained from Calcutta and Cawnpore proved to be the stems and roots of **C. serratum,** *Spr., Wight Ic., t.* 1472; *Bot. Mag., t.* 2536. From enquiries we have made there is no doubt that the latter plant is largely used in many parts of India as a substitute for *Premna herbacea,* the true Gantu Bhárangi, but if we regard the root of *C. serratum* as the true Bhárangi, and the root of *P. herbacea* as the Gantu (or knotted) Bhárangi, there will be no confusion. *C. serratum* has a light-coloured root, very often contorted, and seldom more than an inch in diameter. A light brown epidermis and thin bark cover the tough woody portion, which shows well-marked medullary rays and concentric rings. The drug contains much starch, it is faintly bitter, and has no peculiar odour. The young tops and light blue flowers are used as a vegetable by the natives.

The root of *C. serratum* did not yield anything of great activity when examined chemically, which proves that there is little to recommend it as a medical agent. The wood of the root is almost inert and tasteless; the thin bark constitutes only one-fifth of the weight of the dried root and contains a small quantity of the peculiar bitter principles, dissolved by ether, associated with an acrid resinous substance, and some fatty material. It is interesting to observe, however, that the reactions of the bitter principle, although occurring in such small quantity, were identical with that obtained in the leaves of the other two species, where it formed from ½ to 1 per cent. of the total.

AVICENNIA OFFICINALIS, *Linn.*

Fig.—*Wall. Pl. As. Rar. iii., t.* 271; *Wight Ic., t.* 1481; *Rheede, Hort. Mal. iv., t.* 45. The White Mangrove (*Eng.*), Palétuvier blanc (*Fr.*).

Hab.—Mangrove swamps of Deccan Peninsula and Ceylon. The seeds and bark.

Vernacular.—Bani (*Beng.*), Mada-chettu, Nalla-mada (*Tel.*) Upputi (*Mal.*), Tivara (*Mar.*), Timmar (*Sind*).

History, Uses, &c.—This plant derives its generic name from the celebrated Arabian physician Avicenna (Ibn Sina). The green fruit mixed with butter and boiled is made into a plaster, which is used for softening and maturing tumours, and to promote the healing of the ulceration caused by small-pox. This property of the fruit is alluded to by Camoens in the "Lusaid"—

> "Wide forests there beneath Maldivia's tide
> From withering air their wondrous fruitage hide.
> The green-hair'd Nereids tend the bowery dells,
> Whose wondrous fruitage poison's rage expels."

The bark is astringent and is used by tanners. In Madras the ashes of the wood are used by washermen for washing clothes. The wood is valued on account of its durability under water, and as a fuel for heating furnaces it is preferred to other kinds of wood on the West Coast of India. The seeds are bitter, but are sometimes eaten.

Description.—A shrub or tree with opposite evergreen leaves, which are oblong, entire, and covered beneath with a white pubescence. The flowers are arranged in closely-packed terminal bunches, and are of a dirty yellow colour. The fruit is a broad, compressed capsule, one inch in length, dehiscing by two thick valves; seed erect, cotyledons large, plaited lengthwise, radicle inferior, villous. The roots stand out of the mud in which they grow, overarching each other in erect angled masses, and send up asparagus-like shoots from their underground parts.

Chemical composition.—The bark of *A. officinalis* is used in Madras as a dyeing agent rather than as a tan. It contains a red colouring matter striking a greenish colour with ferric chloride, but giving no precipitate with gelatine. The colouring matter is precipitated by acids and redissolved by alkalies. The ash of the air-dried bark amounts to 11·4 per cent., and is deliquescent.

LABIATÆ.

OCIMUM BASILICUM, *Linn.*

Fig.—*Wight Ic., t.* 868; *Jacq. Hort. Vind. iii., t.* 72; *Rheede, Hort. Mal. x., t.* 87. Sweet Basil (*Eng.*), Grand Basilie (*Fr.*).

Hab.—Persia, Punjab. Cultivated throughout India. The herb and seeds.

Vernacular.—Názbo, Sabza (*Hind.*), Sabja (*Mar., Guz.*), Násbo, Sabja, Baboi-tulsi (*Beng.*), Tirunitru-pachchai (*Tam.*), Vibudi-pattri (*Tel.*), Kam-kasturi (*Can.*).

History, Uses, &c.—The Hindus dislike the smell of this plant; the Mahometans on the other hand are very partial to it. The Arabs call it Rihán or "the herb," and the Persians Shahasperham or "king of herbs," and Názbu, "having a delicate odour"; it is also known in Persia as Habak-i-Kirmáni, "Kirman mint," from its abundance in that province. The author of the *Makhzan* states that it is the اسيم (Ocimum) of

Europeans, who call the large-leaved variety *Ocimum magnum*, and the small-leaved *Ocimum parvum*. The plant is considered to be hot and dry, deobstruent, carminative, and stimulant, and the seeds taken whole are much valued on account of their mucilaginous properties: when crushed they are said to be astringent, and are prescribed in fluxes from the bowels. The juice of the plant snuffed up causes sneezing and clears the brain. *O. basilicum* is probably the ὤκιμον of Dioscorides, but perhaps not of Theophrastus, who describes ὤκιμον as a shrub. The Ocimum of Pliny is probably a kind of clover which also bore this name, as he states that it is given to mares and asses to promote conception.

De Gubernatis (*Myth. des Plant*, ii., 35) gives an interesting account of the history of Basil in Europe where it is considered to be erotic and funereal. In Southern Italy it is worn in the waist or bosom of young girls and in the hair of married women, and is called *Bacia-nicola;* the youths stick a sprig of it above the ear when they go courting. In Tuscany the Basil is called *Amorino.* In Crete it is a sign of mourning, but is universally cultivated in window gardens; Boccacio's story of Isabetta of Messina is too well known to require repetition. De Gubernatis is of opinion that all the superstitions concerning this plant current in Southern Europe are of Byzantine origin. According to the *Apomasaris Apotelesmata*, to dream of Basil is unlucky.

In Europe Sweet Basil is used as a potherb for seasoning certain kinds of food, and is considered to have the same general qualities as thyme, sage, &c. It has long been a popular remedy for mild nervous or hysterical disorders, and in Buenos Ayres its fresh juice is said to be used as an anthelmintic, and to possess the advantage of not tending to produce unpleasant symptoms. Its essential oil was formerly in vogue as a carminative and nervine. (*Med. Record*, xvi., 325.)

Description.—Three forms of this plant are common in India: the mint-like garden basil, with large flowers and green or purple stems; the variety *pilosum* of Roxburgh having a pleasant lemon odour; and a small variety common in gardens and on waste ground having a marked peppermint odour, and hardly different from *O. canum*. The ordinary garden basil has brown nutlets, but those of the pilose variety are black and correspond with the drug imported from Persia under the name of Tukm-i-rihán. They are small, black, oblong nutlets, barely $\frac{1}{16}$ of an inch long, slightly arched on one side and flattened on the other, at the base there is a small projection with a white point. They have no odour, the taste is oily and slightly pungent. When moistened they become coated with a semi-ôpaque mucilage.

Chemical composition.—The leaves distilled with water yield about 1·56 per cent. of a yellowish-green oil, lighter than water (*Raybaud, J., Pharm.* 20, 447), which, when kept, solidifies, almost wholly, as crystallised *basil-camphor;* the solid oil crystallised from alcohol forms 4-sided prisms, having a faint smell and taste; crystallised from water, it forms white, transparent, nearly tasteless tetrahedrons. It is neutral. Formula $C^{20} H^{16} 6 HO$. (*Bonastre, Dumas and Peligot in Gmelin's Handbook*, 14, 359.)

The price of the Persian seeds in Bombay is Rs. 4 per maund of 37½ lbs.

OCIMUM GRATISSIMUM, *Linn.*

Fig.—*Jacq. Ic. Pl. Rar. iii., t.* 495; *Rheede, Hort. Mal. x., t.* 86.

Hab.—Bengal, Chittagong, E. Nepal, Deccan Peninsula. The leaves.

Vernacular.—Ram-tulasi (*Hind. Mar. Beng.*), Elumichamtolashi (*Tam.*), Nimma-tulasi (*Tel.*), Káttu-tuttuva (*Mal.*), Káda-tulasi (*Can.*).

History, Uses, &c.—This plant is the Varvara, Barbara, and Ájvalla of the Nighantás. The leaves have a remarkably grateful lemon odour and taste, and are made into a *chutney* by the Hindus, and are also used as a cooling remedy in gonorrhœa. Baths and fumigations prepared with this plant are used in the treatment of rheumatism and paralysis. A decoction of the mucilaginous seeds is used as a demulcent. This plant has been wrongly identified with the Palangmishk or Faranjmishk of Persia. The seeds imported into Bombay from Persia under these names bear no resemblance to those of *O. gratissimum*.

Description.—Stem erect, woody, perennial; bark ash-coloured; branches opposite, erect, 4-sided, when young smooth, glossy and green, whole height of the plant from 4 to 8 feet; leaves opposite, long-petioled, drooping, oblong, ventricose, remotely serrate, pointed, smooth on both sides, often 6 inches long, including the petiole, which is about a third of the whole; racemes terminal, pretty long, rigidly erect, with the verticels of six flowers pretty close; bracts short petioled, reflexed, cordate lanceolate; calyx, upper lip marked with three nerves; corol short, scarcely larger than the calyx, of a pale yellow underneath, oblong, concave, and entire; filaments longer than the corol, with a large tuft of dark yellow hairs on the joints of the large pair near the base. (*Roxb.*)

OCIMUM SANCTUM, *Linn.*

Fig.—*Burm. Thes. Zeyl.* 174, *t.* 80, *ff.* 1, 2; *Rumph. Herb Amb. v.*, *t.* 92, *f.* 2. Holy Basil (*Eng.*).

Hab.—Throughout India. The leaves.

Vernacular.—Tulsi (*Hind.*, *Guz.*), Tulasi (*Tam.*, *Tel.*, *Mal.*, *Beng.*, *Mar.*, *Can.*).

History, Uses, &c.—The Tulasi plant is venerated in India by the Hindus like the Vervein was amongst the Romans. Its worship is expounded in the *Tulasikavaçam*, a little book composed of two parts: the first being the Tulasikavaçam proper or "Tulasi amulet," from the *Tulasimáhátmya* of the *Brahmanda Purana,* and the second, a hymn in honour of the plant by a certain Pundarîka. The Tulasi is invoked for the protection of all parts of the body in life and death, and especially in its quality of *putradah putrakánkshinám,* or "giver of children." The plant is the beloved of the gods and of pious persons, to whom it affords its *amrita* (ambrosia); it is especially dear to Vishnu and Lakshmi, whence its synonyms Haripriya, Vishnupriya and Lakshmipriya. The divine Nárada has sung the praises of this immortal plant, which contains in itself every perfection, cures every ill, and purifies and guides to the heavenly paradise those who worship it. The mystery of the Tulasi is the mystery of the Creator.

The worship of the plant is strongly recommended to Vishnuites in the latter part of the *Padmapurana,* and it is also worshipped by the followers of Siva. Krishna, the popular incarnation of Vishnu, has adopted this herb for his cult, whence the name Krishna-tulasi. Sita, according to the *Ramayana,* was turned into a Basil plant, which on this account bears the synonym Sitahvaya. The connection between the Tulasi and the Amrita is indicated by the suspension over the plant of a dropping pot of water in the month *Vaisakh.* Worshippers of Vishnu wear a necklace of Tulasi beads, and the Vishnu *dûtas* or "messengers of Vishnu," carry *tulasimani* rosaries. When a Hindu dies, his head is washed with water in which are placed Tulasi leaves and Sesamum seeds, and a sprig of the plant is placed upon his breast as a viaticum. According to the *Kriyáyogasaras,* the devout worshipper of the Tulasi is privileged to ascend to Vishnu's paradise accompanied by 10 millions of his kindred. The wretch who destroys the plant is abhorred of Vishnu, and can never hope for any prosperity; it may only be plucked for religious or medicinal use and when offering the following prayer:—"Mother Tulasi, who brings joy to the heart of Govindas, I gather thee for the worship of Narayana; without thee, O blessed one, every work is vain; that is why I pluck thee; O goddess, be propitious to me. As I gather thee with care, be merciful to me, O Tulasi, mother of the world, I beseech thee."

In worshipping the plant, it is addressed as the goddess Sri or Lakshmi—

> Sakhi, Subhe, Pápahárini, Punyade, Namaste,
> Náradanute, Náráyanamaháhpriye !
> O beloved, O beautiful, O destroyer of the wicked, O purifier;
> Honour to thee, O distinguished of Nárada, O dear to the heart of Vishnu!

The goddess is besought to protect the head (*çiras*), the forehead (*phâlam*), the sight (*driças*), the nose (*grâhnam*) in her quality of *sugandha* or perfumed, the face (*mukham*) in her quality of *sumukhi* or fair of face, the tongue, the neck, the shoulders, the body (*madhyam*) in its quality of *punyadâ*, &c., down to the feet. (*De Gubernatis.*)

The Tulasi plant may be often seen occupying a prominent position in front of Hindu houses; when thus kept it has to be watered and worshipped daily. It is often grown on the top of the Brundavanas* or square brick structures erected in the outer courts of temples, and in Calcutta, even in European compounds, there is hardly a hut occupied by a Darwán or Ooriya bearer without a pot of Tulsi close to the door. Frequently in the evenings a light is kept burning near the plant. Sanskrit writers make two varieties of this plant (founded upon some difference in the colour of their leaves), namely, white and black; the plant, irrespective of colour, is called in Sanskrit Tulasi and Parnasa. According to the *Raja Nirghanta*, it removes cold, destroys intestinal worms and evil spirits, and alleviates vomiting.

The leaves are said to be expectorant, and are prescribed in catarrhal affections. The dried leaves powdered are used as a snuff in a disease called *peenash* (ozœna). Ainslie mentions the use of the root in decoction in febrile affections. In the Concan a decoction of the leaves with the flowers of *Careya arborea* and black pepper is given in remittent fever. Tulasi is also an ingredient in prescriptions for rheumatism. (See *Vitex trifolia.*) The seeds are mucilaginous and demulcent.

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* वृन्दावन (Vrindavana) is a raised platform of earth or masonry on which the worshippers of Krishna plant and preserve the Tulasi.

Description.—Stem short, woody, perennial; branches numerous, opposite, round, usually dark-purple, hairy; leaves opposite, petioled, oval, serrate, downy, about 1½ inch long and 1 inch broad; racemes terminal, erect, usually dark-purple, hairy, 4-sided; bracts opposite, petioled, cordate, reflex, 3-flowered; seeds black, oblong, about $\frac{1}{16}$ of an inch long, slightly arched on one side and flattened on the other, blunt-pointed.

Other labiate plants, officinal in the East on account of their mucilaginous nutlets, are:—

Salvia plebeia, *Br.*, and **S. ægyptiaca,** *Linn.* var. *pumila* Bth. *Dcne. in Jacq. Voy. Bot.* 128, *t.* 133. The former plant is common in many parts of India, and the latter in the Salt Range and Trans-Indus, extending to Sind and Beluchistan.

The nutlets of *S. plebeia* are very small, $\frac{1}{30}$ of an inch long, ellipsoid, smooth, and of a brown colour; they are valued on account of their mucilaginous properties, and are administered internally in gonorrhœa. They are supposed to have strengthening properties, and are given to promote the sexual powers like many other mucilaginous drugs. The statement that they are used for killing vermin is a mistake. The plant is known as *Sathi* and *Samundar-sok* in the Punjab and Sind, and the seeds are sold in the bazars under the name of *Kammar-kus* or "strong-back." Theophrastus (II. P. ix., 19) mentions a κραταίογονος or "strong-back" which has not been identified. The Greeks were acquainted with *S. officinalis*, the *Elelisphakos* or *Sphakos* of Theophrastus (H. P. vi., 1, 2), and the *Elelisphakia* of modern Greece.

The nutlets of *S. ægyptiaca* var. *pumila* are much larger ($\frac{1}{12}$ of an inch), and are used in the north of India as a substitute for *Tukm-i-bálung.*

Chemical composition.—The seeds of *S. plebeia* have the following composition:—Water, 10·44; oil, 18·68; albuminoids, 11·90; gum and fibre, 43·98; ash, 15 per cent. No alkaloid is present. The nitrogen amounts to 1·88 per cent.

Lallemantia Royleana, *Benth.*, furnishes the nutlets sold in the bazars as *Tukm-i-bálung.* It is a plant of the Salt Range and Trans-Indus, extending to Persia, from whence the drug is imported *viâ* Bombay.

As met with in commerce, they are black, $\frac{1}{8}$ of an inch in length, oblong, smooth, 3-angled, tapering towards the umbilicus, which is marked by a white spot; one side of the seed is broader than the other two, and slightly arched. The seeds when moistened become immediately coated with a tenacious, opaque, tasteless, grey mucilage.

Under the name of *Faranjmishk* or *Biranjmishk*, Arabic forms of the Persian name *Palangmishk*, the nutlets of an unidentified labiate plant are imported from Persia.

They are about $\frac{1}{12}$ of an inch in length, brown, oblong, smooth, 3-angled, tapering towards the umbilicus, which is marked by a white spot. When moistened they become coated with a transparent mucilage. The taste is feebly pungent.

The plant from which they are said to be obtained is described by Persian medical writers as having a clove-like odour, on which account it is often called *Karanfal-i-bustani*, "garden clove." According to Abu Hanifeh, it is the same as the plant called by the Arabs *Asába-el-fatiyát* (*Calamintha Clinopodium*, Benth., the Wild Basil). It is considered to be cephalic, astringent, cardiacal, tonic, and carminative.

COLEUS AROMATICUS, *Benth.*

Fig.—*Wight Ill. ii., t.* 175; *Bot. Reg., t.* 1520. Country Borage (*Eng.*).

Hab.—Moluccas. Cultivated throughout India and Ceylon. The leaves.

Vernacular.—Páthar-chúr (*Hind., Beng.*), Pán-ova (*Mar.*).

History, Uses, &c.—This plant, found in every Indian garden, is the *Coleus aromaticus* of Loureiro, who describes it as resolvent, tonic and cephalic, and useful in asthma and chronic cough; also in epileptic and convulsive affections. Roxburgh (*Fl. Ind.*, iii., 22) remarks that the leaves and all parts of the plant are delightfully fragrant, they are frequently eaten with bread and butter, also bruised and put into country beer, cool tankards, &c., being an excellent substitute for Borage. Amongst the natives of India the juice is a domestic remedy in colic and dyspepsia, and the crushed leaves are applied to relieve the pain and irritation caused by the sting of the centipede. The chopped leaves, made into pellets and dipped in a paste made of the flour of the chickpea, are fried in butter and eaten. Food prepared in this manner is a favorite Indian dish and is called भजें (*bhajen*). Dr. Wight speaks of the plant as a powerful aromatic carminative, given in cases of colic in children, in the treatment of which the expresssd juice is prescribed mixed with sugar or other suitable vehicle. In his own practice he observed it to produce so decidedly an intoxicating effect that the patient, a European lady, who had taken it on native advice for dyspepsia, had to discontinue it, though otherwise benefiting under its use. The Rev. J. Long (*Journ. Agri-Hort. Soc., Ind.*, 1858, x., p. 23) also notices its intoxicating properties. In the *Dict. Econ. Prod. of India*, ii., 504, it is stated on the authority of Dr. A. C. Mookerjee that the expressed juice of the leaves is considered an anodyne and astringent, and is applied round the orbit in cases of conjunctivitis. One of us has taken large doses of the fresh juice of the leaves without observing any intoxicating effect, and Mr. J. G. Prebble, who has experimented with a *succus* prepared from the fresh herb, informs us that in large and repeated doses it did not produce the slightest intoxicating effect. The *succus*, a sample of which he has kindly supplied, had the smell and taste of weak infusion of liquorice root.

Description.—The leaves of *C. aromaticus*, which are broad, ovate-crenated, and very thick, are about 3 inches long, and thickly studded with hairs, which on the upper-surface are principally jointed and tapering, but a few are simple and surmounted by a globular, transparent, brilliant gland like a minute dewdrop. On the under-surface the glandular hairs are most numerous, and give rise to a frosted appearance. The epidermis is provided with numerous simple stomata. The venation is reticulate, and remarkably prominent on the under-surface of the leaf. A few oil globules are met with in the parenchyma, but the aroma is chiefly situated in the glandular hairs. The taste of the leaf is at first pleasantly aromatic, afterwards very pungent; the odour is agreeable and refreshing.

ANISOCHILUS CARNOSUS, *Wall.*

Fig.—*Wight Ill.*, *t.* 176 *b*, *f.* 1; *Linn. Amœn. Acad. x.*, 56, *t.* 3; *Rheede, Hort. Mal. x.*, *t.* 90.

Hab.—Western Himalaya, Central and Southern India. The leaves and essential oil.

Vernacular.—Pán-jira (*Hind.*), Kápúrli, Pán-jiren (*Mar.*), Karppúra-valli (*Tam.*), Roga-chettu, Omamu-aku (*Tel.*), Chomara, Kúrkha (*Mal.*), Dodda-patri (*Can.*).

History, Uses, &c.—Ainslie states that the fresh juice of the leaves mixed with sugar-candy is prescribed by the Tamil physicians in cynanche, who also prepare with it, in conjunction with the juices of other herbs and gingelly oil, a cooling liniment for the head. Dr. G. Bidie (*Madras Quart. Med. Journ.*, 1862, Vol. V., p. 269) describes it as a mild stimulant expectorant. Its properties depend upon a volatile oil.

In the *Dict. Econ. Prod. of India* it is stated on the authority of Surgeon-Major North that the juice of the leaves mixed with sugar and human milk is a popular domestic remedy for children's coughs in Mysore.

Description.—Stem erect, tetragonal; leaves petioled, ovate-rounded, obtuse crenated, cor date at the base, or rounded, thick, fleshy, hoary and tomentose, or villous on both sides; spikes long peduncled, at length cylindric; floral leaves ovate-obtuse; upper lip of calyx acute, glabrous, membranaceous, ciliated on the margin; lower lip truncate, quite entire; corolla bilabiate; upper lip bluntly 3 to 4-cleft, lower lip entire; flowers lilac.

LAVANDULA STŒCHAS, *Linn.*

Fig.—*Barrel. Ic., t.* 301. Arabian or French Lavender (*Eng.*), Stœchas Arabique (*Fr.*).

Hab.— Mediterranean Coasts to Asia Minor and Arabia. The flower spikes.

Vernacular.—Dhåru (*Hind.*), Ustukhudus (*Ind. Bazars*).

History, Uses, &c.—Dioscorides states that this plant is called Stœchas from its growing on the Stœchades, a group of islands on the South Coast of Gaul near Massilia, now called Isles d'Hyères. It is the اسطادوس or اسطيقوس of Ibn Sina. It is much used by Mahometan physicians, who consider it to be cephalic, resolvent, deobstruent and carminative, and prescribe it in chest affections; they also think that it assists in expelling bilious and phlegmatic humors. (Cf. *Dios.* iii., 28; *Paul. Æg.* vi.; *Plin.* 26, 27.)

The author of the *Makhzan-el-Adwiya* devotes a whole folio page to a description of its properties, and especially enlarges upon its cephalic virtues; he concludes by saying, "In short Ustukhudus is the broom of the brain, it sweeps away all phlegmatic impurities, and removes obstructions, strengthening its powers, expelling vain crudities, and rarifying the intellect."

In Western India the drug is best known, though incorrectly, under the Portuguese name of Alfazema,* which is corrupted by the natives into Alphajan. In European medicine the flowers furnish the base of the *sirop de stœchas composé*, and are sometimes distilled for the sake of their essential oil, which is known as "false oil of Spike," the true oil of Spike being the produce of *L. Spica.*

L. Stœchas is known in Spain as "Romero Santo" (sacred rosemary). Its essential oil (also that of *L. dentata*) is there obtained for household use by suspending the fresh flowering stalks, flowers downward, in closed bottles and exposing them for some time in the sun's rays; a mixture of water and essential oil collects at the bottom, which is used as a hæmostatic and for cleansing wounds. (*J. C. Sawer.*)

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* *Lavandula vera, L. Stœchas,* is called Rosmarinho by the Portuguese in Europe.

Description.—The purple flowers occur in short-stalked spikes and are situated in the axils of downy, heart-shaped bracts. The upper bracts, which are abortive, form a purple tuft at the top of the spike. The drug has a camphoraceous odour and a hot bitter taste. The odour of the oil, which is of a reddish-yellow colour, recalls that of oil of rosemary.

Chemical composition.—The specific gravity of Spanish oil of *L. Stæchas* is 0·942 at 15° C. It boils between 180° and 245°. (*J. C. Sawer, Chem. and Druggist*, 1891, No. 567.)

Commerce.—The drug is largely imported from Europe. Value, Rs. 8 per maund of 37½ lbs.

JADEH.

The جعدة of the Arabian physicians is generally considered to be the Fuliyun (πόλιον) of the Greeks; by some supposed to be the Poley-Germander (*Teucrium Polium*, Linn.); it is described as deobstruent, diuretic, anthelmintic, and tonic. (*Diosc.* iii., 115; *Plin.*, 21, 60, 84.) Dumolin, however, maintains the πόλιον of the Greeks and the Polium of Pliny to be *Santolina chamæcyparissus*, the "Lavender Cotton" of our gardens. Ibn Sina describes Jadeh as نوع من الشيح, "a kind of wormseed." Persian writers on *Materia Medica* give *Gul-i-urba* and *Amberbed* as its synonyms.

Dr. Jayakar, Civil Surgeon at Muscat, and a distinguished Arabic scholar, forwarded to one of us in 1885 a plant growing on the hills near that town which is called Jadeh, and also a specimen of the Jadeh of the Muscat shops which comes from Bandar Abbas. Both of Dr. Jayakar's specimens are woody, labiate plants, with linear leaves and terminal crowded spikes of flowers, both are densely covered with a cotton-like down, more especially the Persian specimen. The two plants are evidently very closely related; they are used in febrile affections by the Arabs, one ounce being steeped in cold water all night, and the infusion strained and taken in the morning. In infantile fevers the body is fumigated with the drug.

The specimens were forwarded to Kew, but have not, as far as we know, been identified. The Bander Abbas Jadeh, as sold in the shops, consists of the flowers mixed with a few leaves and stems. The flowers are about $\frac{3}{16}$ of an inch long, and only protrude a little from the cottony calyx; they are permanent and firmly attached to the seeds, which are black, rugose, and somewhat kidney-shaped. The odour of the drug somewhat resembles that of wormseed, while that of the Arabian plant is more like lavender.

POGOSTEMON PARVIFLORUS, *Benth.*

Syn.—*P. purpuricaulis*, Dalz. in *Hook. Kew Journ. ii.*, 336.

Hab.—Sub-tropical Himalaya, Deccan Peninsula. The root and leaves.

Vernacular.—Pangala, Phangala (*Mar.*).

History, Uses, &c.—This plant hardly differs from *P. purpurascens*, and is very closely related to *P. plectranthoides*, *P. glaber*, and the variety *suavis* of *P. Patchouli.* It does not appear to be mentioned by Sanskrit medical writers, but the root has a popular reputation as a styptic. In the Ratnagiri District of Western India, the root has long been in use amongst the natives as a secret remedy for the bite of the Phúrsa snake, and in February 1871, Mr. H. B. Boswell, the Collector, addressed the Civil Surgeon in the following terms:—"I have the honor to send you a specimen of a root which I have reason to believe to be a cure for the bite of the Phúrsa snake, and I shall feel very much obliged to you if you can in any way ascertain its medicinal properties and its effect on any one so bitten.

"It is said to stop all the after ill-effects of this poisonous bite, which is more than Liquor Ammoniæ will, I believe, often do. The patient is to eat as much of it, after it has been washed, as would make in bulk the size of the first joint of one's first finger. This he is to do three times a day for seven days. It is also to be applied externally to the wound. I cannot, of course, vouch for the truth of this, or the efficacy of the cure, but one of my sepoys, who was bitten by a Phúrsa a week ago, has been doctored by the *Patel* (village headman) of this place, in this manner, and is now apparently well. The *Patel* after much persuasion has shown me the root and the plant, one I know well, but the name of which I am not at liberty at present to mention. He also assures me that this is all he uses."

The plant was forwarded in April 1871 to the Chemical Analyser to Government, who identified it as a species of *Perilla*, and expressed an opinion that it was highly improbable that a plant belonging to the Labiatæ would prove to be a specific for snake-poisoning, and suggested that some trustworthy evidence of its value should be obtained before he undertook an analysis. In June of the same year, Dr. C. Joynt, the Civil Surgeon, reported the following case:—"A sepoy, aged 27, was admitted on the night of the 29th; Liquor Ammoniæ was applied to the wound after incising; next morning there was hæmorrhage from the wound, and also free hæmorrhage from the gums and tongue, the blood escaping had a bright arterial hue. A scruple of the root was ordered three times a day. The first dose decidedly relieved the vertigo which he complained of, and next day there was a marked diminution in the hæmorrhage from gums and tongue, which entirely ceased on the fourth day. No other medicine was given." Dr. Joynt remarked:—"The employment of the root in this case appears to have been singularly beneficial, and to deserve further investigation."

Unfortunately, Dr. Joynt left Ratnagiri shortly afterwards and was unable to continue his investigations. In the Annual Report of the Ratnagiri Police Hospital for the year 1873-74, the following remarks by Dr. E. H. R. Langley, the Civil Surgeon, occur:—"Snake-bites furnished two cases; these injuries were caused by snakes called 'Phúrsa' by the natives (*Echis carinata* of ophiologists). A rapid cure was effected by the internal administration, together with local application of the root of a shrub, '*the Pogostemon purpuricaulis,*' very common all over the Concan." In 1874 Dr. Langley made the following report to the Deputy Surgeon-General:—"Thirteen cases arising from the bites of poisonous snakes were treated in the Civil Hospital, Ratnagiri. The only remedy used was the pounded root of a plant called *Pangla*, the '*Pogostemon purpuricaulis* of botanists'; the root of this plant is given internally as well as applied as a paste locally; all these cases did well, and were discharged from two to four days after admission."

In 1884 Dr. H. McCalman, Civil Surgeon, Ratnagiri, forwarded a communication, "*On the treatment of Phoorsa bite by Pangla root with illustrative case,*" to the Bombay Medical and Physical Society, from which we extract the following remarks:— "The *Echis carinata,* a viperine snake, is very common in the Ratnagiri District. Fayrer describes it as fierce, active and aggressive, always on the defensive, and ready to attack. The bite is eventually highly dangerous, although the symptoms may be slow in developing. In fatal cases death usually occurs in from 4 to 6 days, and is preceded by giddiness, great lethargy and depression, hæmorrhagic discharges, albuminuria, and occasionally lockjaw."

* * *

"Pangla root, chewed in a fresh state, has been used for some years by Drs. Joynt, Langley, Barker and myself in the treatment of Phoorsa bite, and with invariable success."

The following is Dr. McCalman's illustrative case:—Rowjee Balsawant, Hindoo, police constable, aged 45, was admitted to hospital on the 14th June 1884, at 6 A.M. An hour previously he was bitten on the dorsum of the foot by a Phoorsa snake, afterwards recognized and killed. He was immediately given Pangla to chew, and a poultice of the leaves applied locally. At 9 A.M. there was much pain in the part, œdematous swelling of the foot and ankle, extending half-way up the leg, giddiness, a feeling of great depression, and hæmorrhage (dark-coloured) from the gums, under surface of the tongue and buccal mucous membrane generally. The blood expectorated did not coagulate. This bleeding had begun at

6 A.M., an hour after the man had been bitten. Pulse 72, temperature 98° F., no dyspnœa. Finding the hæmorrhage unchecked by the remedy, some perfectly fresh root just dug up was substituted for that first given. The effect was soon apparent.

At 2 P.M., giddiness less, pulse 78, temperature 99°, expression tranquil, urine dark-coloured, depositing a slight flocculent sediment, reaction acid, sp. gr. 1012, albumen to a considerable extent. Pain of the foot less.

6 P.M., bleeding from the mouth practically stopped, giddiness increased, pulse 72, temperature 99°·4. Urine shows blood corpuscules under the microscope.

15th.—No hæmorrhage from the mouth; urine contains a considerable quantity of blood; vertigo less. Swelling of limb less. Pulse as yesterday and of fair volume.

16th.—No hæmorrhage whatever. No giddiness. Urine pale, no sediment, no albumen, sp. gr. 1008. Pulse 66. Stiffness of foot, but no real pain.

17th.—Swelling rapidly disappearing. No head symptoms. Urine very pale and plentiful, sp. gr. 1004.

18th.—Pangla omitted. His convalescence was uninterrupted, and he left the hospital on the 22nd perfectly well.

Dr. McCalman remarks:—"I do not pretend to explain the action of Pangla; that the remedy acts generally and physiologically is apparent from the early drying up of remote hæmorrhages (*e.g.*, bleeding from the urinary tract) and the relief of cerebral symptoms, effects due to a restoration of the natural state of the blood, and, through it, of the nervous centres. The drug may also stimulate organs concerned in the elimination of the poison. The subject is one which calls for further careful experimental research."

Through the courtesy of Surgeon-General Pinkerton we have been supplied with further extracts from the records of the Ratnagiri Civil Hospital, which show that Pangla root is still used with the same success in the treatment of Phúrsa bite.

Only one fatal case is recorded, and in that the remedy was administered in the form of tincture instead of in the usual manner.

Mr. G. W. Vidal, C.S., in a letter to the *Bombay Gazette*, dated January 30th, 1890, states that the bite of the Phúrsa snake is apparently fatal in about 20 per cent. of cases, and the action of the poison is slow. He says: "In collecting materials for an account of the snakes of Ratnagiri for the *Bombay Gazetteer*, I found (in 1878) records of 62 fatal cases treated at the Civil Hospital. These cases showed that death occurred on an average in four and a half days, though in some instances patients had lingered up to twenty days." In 1855-56 Dr. Imlach, then Civil Surgeon of Shikarpur, in a description of the 'Kapar' (*Echis carinata*), published in the *Transactions of the Bombay Medical and Physical Society* (Vol. iii., New Series, p. 80), wrote that "a reference to police returns will show that in by far the majority of cases serious injury and death have been caused by the bite of this species." In an article upon the "Venomous Snakes of North Canara" (*Journ. Nat. Hist. Soc. Bombay*, Vol. v., No. 1, p. 69), Mr. Vidal says:—" There is indeed no doubt that the *Echis* is a far more potent factor than any other venomous snake in swelling the mortality of the Bombay Presidency, and it is important that this fact should be more generally known and recognised than it has been hitherto. It is, of course, impossible to show the exact percentage of the deaths from snake-bite for which the *Echis* is responsible. In the returns no attempt is made to discriminate the species to which the recorded deaths are attributable, and little if any reliance could be placed in the statistics, even if such an attempt were made. But the conclusion stated above may, I think, be fairly drawn from the fact, which is very clear from the returns in their present shape, that in all those districts, where the *Echis* is known to abound, the average mortality from the snake-bite is *markedly* high, while conversely, the mortality is insignificant in other districts where the *Echis* is either rare or absent. The following table, which I have compiled with some care and labour from the official returns for the eight years, 1878—85, shows the population, the actual average mortality, and the mortality per *mille* of each district in the Bombay Presidency :—

District.	Population by Census of 1881.	Average actual mortality from snake-bite, 1878 to 1885.	Average mortality per *mille*, 1878 to 1885.
Hydrabad	754,624	181·7	0·247
Thar and Parkar	203,344	48·7	0·239
Karachi	478,688	87·2	0·182
Ratnagiri	997,090	154·5	0·155
Thana	908,548	108·8	0·119
Panch Mahals	255,479	30·5	0·119
Shikarpur	852,986	72·8	0·085
Surat	614,198	41·5	0·067
Kaira	804,800	47·2	0·0586
Broach	326,930	19·1	0·0584
Upper Sind Frontier	124,181	6·7	0·053
Kolaba	381,649	19·8	0·052
Ahmedabad	856,324	39·6	0·046
Sattara	1,062,350	41·0	0·038
Kanara	421,840	16·0	0·037
Belgaum	864,014	30·2	0·034
Poona	900,621	18·6	0·020
Dharwar	882,907	17·6	0·019
Khandeish	1,237,231	23·1	0·018
Bijapur	638,493	11·0	0·017
Nasik	781,206	10·8	0·0138
Ahmednagar	751,228	10·3	0·0137
Sholapur	582,487	2·2	0·003

Thus three Sind districts and Ratnagiri, in all of which the *Echis* swarms in suitable localities, stand well at the top of the list with an average mortality, taking the four districts together of ·205 per 1,000. On the other hand, in the last four districts on the list, *viz.*, Bijapur, Nasik, Ahmednagar and Sholapur, the combined average mortality per *mille* is only ·0118. In other words only one man dies of snake-bite in about 100,000 in these Deccan districts, while in the *Echis*-ridden tracts one man dies in every 5,000. Daboias and kraits are probably nowhere so common in Western India as to have much appreciable effect on the mortality. But cobras are quite as common, I believe, in these Deccan districts as they are in Ratnagiri or

Sind. This shows, I think, pretty conclusively that the *Echis* —and not the cobra, or any other venomous snake—is chiefly responsible for deaths from snake-bite in Bombay."

The fresh leaves of *P. parviflorus* have a pungent taste, and when bruised are in general use in the Concan as a cataplasm to clean wounds and sores, and to stimulate healthy granulation.

Description.—A stout, erect, branched shrubby plant; glabrous, pubescent, or scaberulous. Leaves long-petioled, ovate or ovate-lanceolate, singly or doubly crenate-toothed or serrate, base cuneate, whorls subglobose, in dense cylindric or one-sided softly hairy spikes, bracts elliptic-ovate, exceeding the hirsute calyx, calyx-teeth short, triangular-lanceolate, ciliate. Nutlets very small, black, shining. The whole plant has a strong black currant odour. Roots woody, knotted; bark light brown, scabrous, with an aromatic odour like that of the plant, and a pungent taste, benumbing the tongue and palate when chewed.

Chemical composition.—The most interesting principle detected in the plant was an alkaloid. After repeated purification it was left as a yellow varnish with slightly bitter and mouse-like flavour. It was more soluble in chloroform than in ether. No special colour reactions were noted. We also detected the presence of trimethylamine, and a volatile principle with a cedar-wood odour. Resinous principles were also present, with astringent matter. We provisionally call the alkaloid *Pogostemonine.*

MENTHA SYLVESTRIS, *Linn.*

Fig.—*Reichb. Ic. Fl. Germ., t.* 82; *Eng. Bot.* 686. Wild Mint (*Eng.*), Menthe sauvage (*Fr.*).

Hab.—Temperate W. Himalaya, Persia. The herb.

Vernacular.—Pudína or Púdina (*Hind., Tam., Beng., Guz.*), Chetni-maragu (*Can.*), Vatalau, Pudína (*Mar.*).

History, Uses, &c.—A fragrant plant named *μίνθα* or *μίνθη*, in Latin Mintha or Mentha, was known to the Greeks and Romans (*Theophr.*, ii., 4; *Plin.*, 19, 47; 20, 53), which was probably a kind of mint. According to Pliny, the name of this plant was afterwards changed to ἡδύοσμον on account of the sweetness of its smell. It was used as an ingredient in sauces and for medicinal purposes; it is impossible to determine with certainty which species of mint was used by the ancients, but it is generally supposed to have been *M. sativa*, Linn.

Ovid tells us that Myntha was a nymph beloved of Pluto, who was turned into a plant by Proserpine out of jealousy. De Gubernatis (*Myth. des Plant.*, ii., 226) says:—"Les Français l'appellent *Menthe de Nostre Dame*, les Allemands *Unser Frauen Müntz*, Pietro de Crescenzi, *Herba sanctæ Mariæ*. Dans la *Naturale et generale Historia dell' Indie Occidentali* (Ramusio) on lit: "L'*herba buona*, che in alcune parti chiamano *herba santa*, e in molto altre *menta*." Dans les *Allégories d'Azz Eddin*, traduit par Garcin de Tassy, la menthe semble jouer, au contraire, un assez vilain rôle. Le basilic en parle ainsi au jasmin: "Tu auras peut-être entendu dire qu'il existe un délateur (la menthe) parmi les êtres de mon espèce; mais, je t'en prie, ne lui fais pas de reproches; il ne répand que sa propre odeur; il ne divulgue qu'un secret qui le regarde; il ne dévoile enfin que ce qu'il peut découvrir." Quelle allusion peut contenir cette allégorie? Est-il possible que la vieille équivoque latine entre les mots *mentha* et *mentula* se soit répétée dans une langue orientale? * Quant à la première, elle est certaine, et les poètes pornographiques italiens en ont bien abusé. Il faut sans doute encore songer à cette équivoque, pour comprendre l'origine de la superstition Sicilienne de Caltavuturo, dans la province de Palerme; on y croit que si la femme dans ses mois s'approche de la menthe, la plante périra; autrefois, au lieu de *menta*, on entendait probablement *mentula:* d'où la croyance qui, autrement, serait inintelligible.

Apulée, *De Virtutibus Herbarum*, indique le rite qu'il faut suivre pour cueillir la menthe: "Lege eam mense Augusto, mane primo priusquam sol exeat, mundus, ad omnia sic dicens: Te precor, herba *hedyosmos*, per eum qui nasci te jussit, venias ad me hilaris cum tuis virtutibus et effectu tuo, et ea mihi præstes quæ fide a te posco."

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* Immovero sic est, نعنع idem valet.

Mint does not appear to be mentioned by Sanskrit medical writers. In Arabic نعنع (*naanaa*) and حبق (*habak*) are general names for the mints, but they are best known as Fudanaj, the Arabic form of the Persian word Púdina or Púdang. The author of the *Makhzan* describes three kinds of Fúdanaj, wild, mountain, and water mint; the latter, he says, is the Calamintha of the Greeks. Mountain mint is described as having hoary leaves, but it is impossible from his description to form any opinion as to the exact species to which he refers. The mints are considered to be hot and dry, and are prescribed in dyspeptic affections, fluxes, and dropsy. Different kinds of mint are much cultivated in Indian gardens, and are used as domestic remedies on account of their stimulant and carminative properties. They are often made into a medicinal *chutney*, which is eaten to remove a bad taste in the mouth in febrile conditions of the body, *e.g.*, Púdína, khárik (dry dates), black pepper, rock salt, raisins, and cumin in equal proportions are rubbed into a chutney with limejuice.

In colic, mint juice with a little black pepper and honey is given.

Description.—*M. sylvestris* has leaves broadly or narrowly oblong, obovate or lanceolate subacute, serrate, hoary beneath, whorls in terminal spikes, calyx-teeth triangular or lanceolate, corolla hairy, glabrous within. Nutlets usually pale, smooth, sometimes brown and delicately reticulate. (*Fl. Br. Ind.*)

The plant varies much in size and habit. Aitchison observed it in Biluchistan in beds of streams amongst tamarisk shrubs, growing nearly seven feet high and forming large clumps. Another variety was collected by him on the Harirud valley.

Mentha viridis (spear-mint), *M. piperita* and *M. incana* (peppermint), *M. sativa*, and *M. aquatica*, occur in Indian gardens, and as escapes. *M. arvensis* is a native of the Western Himalaya.

Chemical composition.—The most important constituent is the volatile oil, which has the same composition as oil of peppermint, but differs from it in odour and flavour (see p. 107).

The plant contains a little tannin.

Commerce.—The dried plant of *M. sylvestris* is a regular article of import from Persia into Bombay. Value about 2 annas per lb.

MENTHA ARVENSIS, *Linn*, var. *piperascens.*

Hab.—China and Japan. The essential oil, and Menthol or Peppermint camphor.

Vernacular.—The oil.—Lin-tsao (*Chin.*), Hakano Abura (*Japan*), Púdine-ka-têl *or* atar (*Hind.*, *Beng.*), Vatalau-cha-têl (*Mar.*), Phudino-nu-têl (*Guz.*), Pudina attar *or* tailam (*Tam.*), Pudina-attaru *or* tailamu (*Tel.*), Pudina-attar *or* yanne (*Can.*). Menthol.—Po-ho-yo (*Chin.*), Hatsca (*Japan*), Pudine-ke- phúl (*Ind. Bazars*).

History, Uses, &c.—Peppermint was in use in China and Japan at least 2,000 years ago. The Fudanaj-el-tays, "Mentha hircina," of Ibn Sina appears to have been peppermint; he describes it as a very efficacious kind of mint and a good diuretic. Haji Zein el-attar (1368) mentions a kind of mint called Filfilmún, *i.e.*, "having the qualities of pepper," also known as Púdineh-i-kohi or "hill mint." Both the Arabs and Persians appear to have been well acquainted with the value of this mint in neuralgic affections. It is interesting to observe that in Hull's *British Flora*, Manchester, 1799, peppermint is named *Mentha hircina.* Peppermint is not mentioned by Sanskrit writers on *Materia Medica.* From the *Pharmacographia* we learn that *peper-mint* was first observed by Dr. Eales and communicated to Ray, who noticed it in his *Synopsis* in 1696. Dale, in 1705, states in his *Pharmacologiæ Supplementum* that it is esteemed a specific in renal and vesical calculus; and Ray, in the third edition of his *Synopsis*, declares it superior to all other mints as a remedy for weakness of the stomach and for diarrhœa.

Upon the Continent of Europe peppermint became practically known about the latter end of the last century (*op. cit.*, 2*nd ed.*, p. 481). Peppermint camphor was first described by Gmelin in 1829, who obtained it from the European plant. Pereira and Guibourt notice the menthol of China, and in 1862 a memoir on crystallized oil of peppermint from Japan was presented to the Chemical Society by Oppenheim, who speaks of it as coming to Europe in earthenware jars, and often adulterated with sulphate of magnesium to the extent of 10 to 20 per cent This, however, was not the case with a sample examined by Moss and also by G. H. Beckett and C. R. Alder Wright in 1874. When first brought to Europe it was used as a remedy for headache and neuralgia, and was known in France as *Gouttes Japonaises.* In 1879 Mr. Archibald Duncan, a student of the University of Edinburgh, drew attention in the *Lancet* to its value as an antiseptic. Dr. A. Rosenberg (*Lancet,* 1885) recommended an alcoholic or ethereal solution as a local anæsthetic in affections of the nose, pharynx, and larynx. The use of menthol for these purposes has now become general in Europe and America. Dr. Lahnstein (*Therap. Monatsh.,* 1890, No. 5) has used menthol with striking success against vomiting in a child with traumatic peritonitis where opium and morphine had failed.

Dr. Drews (*Therap. Monatsh.,* 1890, No. 7) has conditionally confirmed the communications of Gottschalk and Weiss concerning its value in obstinate vomiting of pregnancy.

Dr. Bronner of Bradford reported at the 62nd meeting of German Scientists and Physicians in Heidelburg on the success obtained by him with menthol (a few drops of a 20 per cent. solution in olive oil poured on pieces of pumice stone) in obstinate swelling of the tubes as well as in some cases of sclerosis. (*Therap. Monatsh.,* 1890, No. 8.)

Dr. Jones (*Deutsch. Apoth-Zeit.,* 1890, p. 143) has used menthol successfully in 20 per cent. alcoholic solution for inhalation in asthmatic cases. Lastly, the success obtained with menthol against diphtheria must be mentioned.

Dr. Hermann Wolff (*Therap. Monatsh.*, 1890, No. 9) has exhaustively reported on his experience of two years with the treatment. In India it is chiefly used as a stimulant carminative by vegetarians in the same manner as the essential oil of peppermint, which is largely imported from China and Japan. One of us has found a large rectal injection of essence of peppermint in warm water afford marked relief in renal colic.

Description.—Chinese oil of peppermint is generally high coloured and very pungent, with a bitter after-taste. It is now often deprived of its menthol, but still appears to be unable to compete with the Japanese oil which has nearly driven it from the Indian market. The menthol of China and Japan occurs in long hexagonal crystals, resembling sulphate of magnesium, which contain much water. E. B. Kyle (*Amer. Journ. of Pharm.*, 1885) mentions the following among the properties of menthol. When thrown upon water, currents are produced to and from the dissolving crystals. Menthol liquifies with chloral, thymol, and camphor; and this action is particularly noticeable with thymol, crystals of the two substances placed in contact being in a few minutes transformed into a thick oily liquid. On gently heating a mixture of 1 drachm of the aqueous solution of menthol with half a drachm of a solution of 1 grain of iodine and 5 grains of potassium iodide in two drachms of water, with a small quantity of potash solution, the characteristic odour of iodoform is developed. The aqueous solution is not affected by ferric chloride or bromine water, but yields a slight turbidity with chlorine water. One grain of menthol yields, with 120 drops of sulphuric acid, a brownish red liquid of a very disagreeable odour, and on the addition of a little potassium bichromate becomes chrome-green, the colour remaining unaltered for several weeks. Menthol slightly warmed with nitric acid yields a thick, wine-coloured, oily liquid, and at a higher heat red fumes are given off; on neutralizing now with ammonia, a precipitate is observed which is soluble in alcohol, and the solution when evaporated yields an indistinctly crystalline mass.

The oil of *M. arvensis*, var. *piperascens*, distilled from the fresh plant, grown at Mitcham, by Moss had a decided yellow colour, and a sp. gr. of ·9107 at 62° F. With the barometer at 30 in. it boiled at 402° F.

The sp. gr. of the oil after determining the boiling point, was found to be ·9117 at 62° F.

Other specimens of oil distilled in England from the dry imported herb, were found by Moss to be different in appearance and physical properties from that distilled by him. One labelled "non-rect." was distinctly green, and had a sp. gr. of ·9167 at 62°F.; a second, labelled "rect.," was pale in colour, with a faint green tinge, and had a sp. gr. of 9098. The sp. gr. of these oils confirm Todd's generalization that pure oils fall between ·908 and ·917. (*Pharm. Journ.*, p. 446, 1886.) None of the three oils gave any coloration when subjected to the test given in Todd's paper above mentioned. It consists in adding one drop of oil to a mixture of 25 drops of alcohol with one drop of nitric acid, sp. gr. 1·2. With the oil of *M. piperita* a permanent blue or bluish-green colour is developed.

Chemical composition.—Oil of peppermint owes its peculiar odour to *menthol* (mint camphor, mint stearopten), $C^{10}H^{20}O$, which is chiefly contained in the last portions obtained on subjecting the oil to fractional distillation. It forms colourless prisms which fuse at 42° C. and boil at 212° C. Distilled with phosphoric anhydride, it yields *menthene* $C^{10}H^{18}$, which is a colourless liquid of an agreeable odour. According to Moriga (1881), oil of peppermint contains probably also an oil of the formula $C^{10}H^{18}O$, which may be prepared from menthol by oxidation with potassium bichromate; but by treatment with fuming nitric acid menthol yields at first an explosive oil, afterward crystals of an acid $(C^{5}H^{8}O^{4})^{2}H^{2}O$, melting at 97°C.; this compound is not identical with pyrotartaric acid, with which it agrees in composition. A compound isomeric with borneol had been found by Beckett and Wright (1875) in the liquid portion of Japanese peppermint oil, but, according to Flückiger and Power (1880), is not present in the oil distilled at Mitcham, which contains, besides menthol, several hydrocarbons of the formulas $C^{10}H^{16}$ and $C^{15}H^{24}$, and having a terebinthinate somewhat lemon-like odour. (*Stillé and Maisch.*)

Commerce.—Chinese oil of peppermint and menthol are imported into India in quarter-catty flat bottles, bearing a Chinese label. Four or more of these bottles are packed in a tin box. The Japanese oil is packed in tins of various sizes and has generally an English label, much of it is of very inferior quality, the menthol having been separated. Cocking's is the best brand, and is packed in glass bottles with paper cases. Value—oil, Rs. 4 to 5 per lb.; menthol, Rs. 8 per lb.

Indian substitutes for peppermint are **Mentha incana,** *Willd.*, much cultivated in gardens, and wild in Northern India, and **Micromeria capitellata,** *Benth.*, a native of Behar, the Western Himalaya and the Western Ghâts, described by Dalzell as rivalling the peppermint in its aromatic and carminative properties.

ORIGANUM MARJORANA, *Linn.*

Fig.—*Woodv. Med. Bot. t.* 165. Sweet Marjoram (*Eng.*), Marjolaine (*Fr.*).

Hab.—Portugal to Western Asia. Cultivated in India. The herb.

Vernacular.—Marwa (*Indian Bazars*).

History, Uses, &c.—The name *ορίγανον*, in modern Greek *ριγανι*, was applied in ancient times to plants of this genus, but *O. marjorana* was distinguished by the names *σαμψυχον* and *αμαρακος*. A Greek myth informs us that Amaracus was a page to the king of Cyprus, who one day on letting fall a vessel of perfume became so frightened that he was turned into this plant. The Greeks and Romans decorated the newly married with it. Catullus says:—

> Cinge tempora floribus
> Suaveolentis Amaraci.

It is the Marjolaine of the French. De Gubernatis states that in Southern Europe it is the symbol of honour and the protector of married women. It is the Maruva and Jambhira of the Raja Nirghanta and the Marwa or Marzangush of the Persians. Ibn Sina calls it Marzanjush. The Persian word signifies "mouse-ear," a name given to it on account of the greyish downy character of the leaves, which is more marked in the Persian variety than in the European plant. Marjoram is cultivated as a pot-plant in most Indian gardens, and is used as a substitute for thyme in cookery. At Bandora, near Bombay, it is grown as a garden crop to supply *bouquets* for the Bombay market, which are much worn by women in their hair. The medicinal uses of Marjoram in the East are similar to those of mint.

Description.—An annual herb. The leaves are spatulate or oval, very obtuse, entire, gray green, soft-hairy, and pellucid punctate. The flowers are aggregated in small heads and have a small whitish corolla. The plant is agreeably and pungently aromatic.

Chemical composition.—The volatile oil (*Oleum majoranæ*) is thin, yellowish, of the specific gravity 0·89, boils above 163° C., is readily soluble in alcohol, has the aromatic odour of the herb, and, according to Beilstein and E. Wiegand (1882), contains a terpene boiling at 178° C. and forming a liquid compound with HCl; the fraction boiling between 200° and 220° C. has the composition $C^{15}H^{26}O$, and is not affected by metallic sodium. (*Stillé and Maisch.*)

THYMUS SERPYLLUM, *Linn.*

Fig.—*Engl. Bot., xxii., t.* 1514. Wild Thyme (*Eng.*), Serpolet (*Fr.*).

Hab.—Western Temperate Himalaya, Persia, Europe. The herb.

Vernacular.—Másho (*Panj.*), Háshá (*Pers. Ind. Bazars*).

History, Uses, &c.—Háshá is the Persian name of *T. serpyllum*, but it has been adopted by the Arabian and Persian physicians as the equivalent of the θύμος of Dioscorides, a plant concerning the identity of which there is much doubt: some supposing it to be the *Satureia capitata* of Linneus, and others the *Thymus vulgaris* or *T. Zygis* of the same botanist. Ibn Sina in his description of Háshá quotes what Dioscorides says concerning θύμος, and does not notice the ἑρπύλλος of the same author usually identified with *T. serpyllum*. Haji Zein el-Attar follows Ibn Sina in identifying Háshá with the θύμος of the Greeks; and describes it as a kind of mountain mint with very numerous small flowers of a purplish colour, slender stems, and leaves like the *Jadeh*. His description of its medicinal properties hardly differs from that of Pliny (21, 89), which is as follows:—"Thyme is considered to be very beneficial to the sight, whether used as an article of food or as a medicament, and to be good for inveterate coughs. Used as an electuary with vinegar and salt, it facilitates expectoration, and taken with honey prevents the blood from coagulating. Applied externally with mustard, it dispels chronic fluxes of the fauces, as well as various affections of the stomach and bowels; still, however, it must be used in moderation, as it is of a heating nature, and acts as an astringent on the bowels. In cases of ulceration of the intestines, the dose should be one denarius of thyme to one sextarius of oxymel; the same proportions, too, should be taken for pains in the sides, between the shoulder-blades, or in the thoracic organs. Taken with oxymel, it is used for the cure of intestinal diseases, and is administered in cases of alienation of the senses and melancholy. Thyme is given also for epilepsy, when the fits come on, the smell of it reviving the patient; it is said, too, that epileptic persons should sleep upon soft thyme. It is good also for hardness of breathing, and for asthma and obstructions of the catamenia. A decoction of thyme water, boiled down to one-third, brings away the dead fœtus, and it is given to males with oxymel, as a remedy for flatulency, and in cases of swelling of the abdomen or testes and of pains in the bladder. Applied with wine, it removes tumours and fluxes, and in combination with vinegar, callosities and warts. Mixed with wine, it is used as an external application for sciatica; and beaten up with oil and sprinkled upon wool, it is employed for diseases of the joints and for sprains. It is applied also to burns, mixed with lard. For maladies of the joints of recent date, thyme is administered in drink, in doses of three oboli to three cyathi of oxymel. For loss of appetite it is given beaten up with salt."

The ancients appear to have been acquainted with the antiseptic properties of thyme. Virgil (Georg. IV., 241) speaks of the fumigation of beehives with the smoke of the burning plant, and the name θύμος is derived from θύω, to burn incense. Macer Floridus (*De Vir. Herb*) recommends thyme as a remedy for the bites of venomous animals. In the Punjab the seeds of *T. serpyllum* are given as a vermifuge. (*Stewart.*) The plant is an indifferent substitute for *T. vulgaris*, as it contains hardly any thymol. The latter principle is, however, afforded abundantly by the seeds of *Carum copticum*, a plant largely cultivated in India. Thymol is a powerful antiseptic; when absorbed it paralyses the nerve centres in the cord and medulla, and like carbolic acid lessens reflex action, slowing the respiration, and lowering the blood-pressure and temperature. In poisonous doses it causes weakness, drowsiness, coma and death. It differs from carbolic acid in being less volatile and less easily oxidised. Its action as a disinfectant is more permanent and at the same time more powerful than that of carbolic acid. It is less irritating to the skin or mucous membrane, and does not act as a caustic like carbolic acid, and is a less powerful poison to mammals. Its action on the nerve-centres is a paralysing one from the first, and is not preceded by excitement as in the case of carbolic acid. While in the body it appears to effect tissue-metabolism, for in animals poisoned by it the liver is found quite fatty, as in phosphorus-poisoning. It appears to be eliminated by the respiratory and urinary organs and to cause irritation of these organs during the process of excretion. In poisoning by it, the bronchial mucous membrane is extremely congested, the secretion of mucous increased, the lungs congested, and sometimes consolidated; the kidneys inflamed, and the urine albuminous or bloody. Thymol has been used as an antiseptic, as an application to skin diseases, ringworm, eczema, psoriasis; as a gargle, spray, or inhalation in sore-throat, bronchiectasis and phthisis, or as an injection in ozæna. Internally it has been used in diabetes and vesical catarrh. (*Lauder Brunton.*)

Dr. Gross (*Pharm. Zeitsch.*, 1890, p. 261) reports on the successful results obtained with thymol in the treatment of diphtheria, having found it the most effective remedy in 280 cases. He prescribed, according to the age of the child, a 0·1 to 0·3 per cent. solution in doses of 10 to 12 drops every 5 to 10 minutes, according to the severity of the case. The solution was flavoured with some pleasant-tasting syrup and in severe cases a few drops of brandy were added. The children soon become accustomed to the burning taste and willingly take the solution. Besides this there is the advantage that the remedy is perfectly harmless and may be given continually for weeks together. The effect of the treatment in cases of average severity is seen in from 3 to 4 hours.

Thymol is recommended by Küster in whooping-cough in a solution of 1 in 2,000. Three or four times a day he directs this solution to be inhaled by means of an atomiser. According to his experience the cases never assume a violent character when this treatment is begun in time; if, however, the attacks are already frequent and violent they soon diminish in number and severity. The duration of the treatment is between three and four weeks, and healthy children who inhale the spray are protected from whooping-cough. Dr. E. Lawrie (*Lancet*, Feb. 16, 1891) reported two cases of chyluria successfully treated with thymol given internally in doses of one grain every four hours, gradually increased to 5 grains.

Description and Properties.—Thymol crystallizes in thin, colourless, rhombic scales, or is seen in commerce in large translucent crystals of spec. grav. 1·028. It melts between 50° and 52° C. to a colourless liquid lighter than water, retains its fluid condition often for a long time, and boils near 230° C. It has an aromatic thyme-like odour and a warm, pungent but scarcely caustic taste. It dissolves sparingly in water, requiring at 15° C. 1,100 to 1,200 parts for solution, but is soluble in half its weight of alcohol, ether, and chloroform, in 2 parts of soda solution sp. gr. 1·16, and freely in benzol, benzin, carbon disulphide, glacial acetic acid, and fixed and volatile oils. It forms with soda a crystallizable and readily soluble compound, and does not change the colour of a solution of ferric chloride. Symes (1879) ascertained that on being triturated with one-half to ten times its weight of camphor, a colourless syrupy liquid is obtained, but it does not liquefy with chloral hydrate. According to Gerrard, the strongest aqueous solution of thymol available is 1 in 1,000, and a solution of 4 grains of it in a fluid ounce of alcohol is miscible with water without becoming turbid; 3 grains of thymol are dissolved by 1 grain of caustic soda and 1¼ grains of caustic potash. Solid fats, when heated, are excellent solvents of thymol. A solution of 1 part of thymol in 100 parts of warm glycerin remains clear. Thymol is also soluble in 4 parts of cold sulphuric acid; the solution has a yellowish colour, and, on being gently heated, becomes rose-red. On pouring this solution into 10 volumes of water, digesting the mixture with an excess of lead carbonate, and filtering, the liquid becomes violet-blue on the addition of ferric chloride. This reaction is due to *sulphothymolic acid*, $C^{10}H^{14}SO^{4}$, discovered by Lallemand (1853). Hammarsten and Robert (1881) give the following as the most delicate test by which one-millionth of thymol may still be detected: Mix the liquid with one-half of its volume of glacial acetic acid, then with at least an equal volume of sulphuric acid, and warm gently, when a bright reddish-violet colour is produced which is not destroyed by boiling. According to Hirschsohn (1881), a solution of thymol in 60,000 parts of water is rendered turbid by bromine-water, but, according to Hammarsten, the precipitate is not crystalline like tribromophenol. (*Stillé and Maisch.*)

Chemical composition.—The volatile oil of *Thymus Serpyllum*, Linn., according to E. Buri (1879), contains two phenols which do not congeal at—10° C., and of which one imparts a yellowish-green colour to ferric chloride, and yields a sulphonic acid, the salts of which, like the thymol sulphonates, produce with ferric salts an intense blue colour. Jahns (1880) reported also the presence of a little thymol and carvacrol. Messrs. Schimmel & Co. (Report, April 1891) obtained by distillation of the leaves and stalks 0·3 per cent. of an oil having a very pleasant melissa-like aroma with a slight soupçon of thyme. Its specific gravity at 15° C. was 0·917.

Thymus vulgaris, Linn., is the chief source of thymol in Europe; the essential oil is usually sold under the name of Oleum Origani. For the chemistry of thymol the reader is referred to the article upon *Carum copticum*. (Vol. ii., p. 116.)

Fúdanaj-í-jibali, also called Pudineh-í-kohí, "hill mint," is identified by Mahometan physicians with the Calamintha of the ancients (cf. *Matth. Valgr.* v., 2, 76. *f*), *Calamintha vulgaris*, Sweet, *Eng. Bot.* 1676. We have not met with this drug in the Indian Bazars, but three species of Calamintha occur in the Himalayas.

ZATARIA MULTIFLORA, *Boiss.*

Hab.—Arabia, Persia. The herb in flower.

Vernacular.—Saatar (*Ind. Bazars*).

History, Uses, &c.—The Mahometan physicians of the East identify this drug with the ὀρίγανον of the Greeks, and describe it as having properties similar to those of thyme and mint. Dr. Jayakar of Muscat found the plant in flower in May 1885 on the hills near Muscat in Arabia, and kindly forwarded specimens, which were identified at Kew as *Z. multiflora*. The drug is much used in India in infusion as an agreeable aromatic stimulant and diaphoretic; many other properties are ascribed to it in Persian medical works which it is unnecessary to recapitulate.

Description.—The drug has a fragrant odour like lemon thyme, and consists of small ovate, or nearly round, dotted, entire, rather leathery leaves, the largest of which are about ¼ inch long; mixed with them are portions of a slender woody stem and numerous minute flowers, forming knotted clusters upon a slender spike; each flower is furnished with a small bract, and when magnified the bracts and calices are seen to be densely covered with jointed hairs. The calyx is unequally 4-cleft, the corolla labiate, and of a red colour, the calyx and flower after being soaked in water for 24 hours only measured ⅛ inch in length. The leaves when magnified present a mossy surface, which is thickly pitted, each pit containing a granule of red, resinified essential oil.

Chemical composition.—The leaves contain an aromatic essential oil having a minty odour, a red, tasteless, acid resin, and some tannic acid giving a green precipitate with ferric chloride. The bitterness is not due to an alkaloid. The leaves containing 10 per cent. of moisture yielded 13 per cent. of ash.

ZIZIPHORA TENUIOR, *Linn.*

Hab.—Persia, Beluchistan. The herb.

Vernacular.—Mishk-i-taramashia (*Ind. Bazars*).

History, Uses, &c.—The Mahometans of the East identify this plant with the *ζυγις* or "wild thyme" of the Greeks. It is the مشكطرا مشيع of Ibn Sina, who describes it as very hot and dry. Haji Zein in the *Ikhtiarát* states that it is called Rang in Shiraz, and that the milk of goats feeding upon it becomes bloody. He describes it as a valuable expectorant and lithontriptic in doses of one mithkal, but says that it sometimes causes hæmaturia. He also mentions its use by Galen as a suppository in painful affections of the uterus, and by Ishak as a carminative addition to purgative medicines. The drug is also said to be a powerful aphrodisiac. Aitchison states that the peasants in the Harirud Valley and Khorasan call the plant *Kakuti.*

Description.—A very small plant, 2 to 3 inches high; root as long as the plant, single, woody, with a few small fibres. The stems, which are 2 to 5 in number, are also woody, and branch from the ground; they are thickly set with leaves and flowers, which reach to the apex and form a spike. The leaves are linear-lanceolate, and have several prominent straight veins on each side of the midrib. The calyx, which is purple, encloses four oblong seeds of a brown colour, and is marked with numerous ribs, and ends in five sharply cut claws; it is studded with simple hairs, and is $\frac{5}{16}$ths of an inch long. The odour and taste of the drug is pleasant, like peppermint, but sweeter.

Zufah-i-yabis.* From an examination of the drug it appears to be a small plant, 6 to 8 inches high; stem not thicker than a crow-quill, 4-angled, purplish, branched from the base, which is woody; root woody, seldom branched; flower heads numerous, oblong; calyx striated, hairy, purple, with five sharp teeth; seeds naked, four in number, oblong, 3-angled, of a pale brown, studded with rows of small round tubercles; on one side of the hilum there is a fringe of smaller tubercles very closely set, and on the other two elongated white prominences. As found in commerce the plant is much broken up; it has a pleasant odour like sweet hay. Taste bitter; properties, according to native writers, stimulant, anthelmintic, and deobstruent. The drug is generally attributed to *Hyssopus officinalis*, but this cannot be correct, as the flowers are in oblong spikes. It is imported from Persia.

H. parviflora, *Benth.*, is a native of the temperate Himalaya.

Chemical composition.—Besides tannin, resin, fat, sugar, mucilage, &c., the most important constituent of Hyssop is *oil of hyssop*, of which the fresh herb yields ¼ to ½ per cent. It is pale-yellow or greenish, limpid, of about the specific gravity 0·94, and freely soluble in alcohol; it contains oxygen, and commences to boil at 142° C., the boiling-point rising to 180° C. It has the odour and taste of the herb. The *hyssopin* of Herberger (1829) was found by Trommsdorff to be impure sulphate of calcium.

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* Sibthorp states that *Satureæa grica*, Linn., is the ὕσσωπο of the modern Greeks, and the زوفه of the Turks. In Sind *Nepeta ciliaris*, Benth., is called Zufah.

Badranjboya, Baklat-el-Utrujiya (*Arab.*). Imported from Persia.

Description.—Calyx striated, hairy, 5-fid, not so long as that of Zúfah-i-yábis, and not coloured; seeds four, naked, brown, 3-angled, nearly smooth, a white patch on each side of the hilum; flowers in axillary clusters of about 6, upon a short peduncle; leaves ovate, margin deeply dentate, somewhat hairy. The drug is always much broken and consists chiefly of stem and fruit; the former is quadrangular, much larger than that of Zúfah, of a purplish tint. Taste bitter, odour faintly aromatic. This herb is supposed to represent the μελισσόφυλλον of Dioscorides and Theophrastus, generally known in Latin as Apiastrum. Virgil (G. 4, 63) calls it Melisphylla, and Theophrastus (4, 25) ἐνώδης μελίτεια. It is a plant beloved by bees, the Balm Gentle or *Melissa officinalis* of our gardens. When fresh it has a pleasant lemon odour, which is not retained by the dry plant. It was formerly valued as a corroborant in hypochondriacal affections, and the Persian drug is still used for this purpose by Indian *hakims*. In Europe, Balm tea is still a domestic remedy, and is given as a grateful diluent in febrile affections: it has a place in the French Codex. The different species of Melissa are widely diffused, being found in Europe, Central Asia, and North America.

Chemical composition.—The leaves of *M. officinalis* contain, besides the common constituents of plants, a small quantity of tannin and bitter principle, and about ⅛ to ¼ per cent. of volatile oil, which is colourless or yellowish, has a specific gravity of about 0·89; dissolves in about 5 parts of alcohol, sp. gr. 0·85, and contains a stearopten.

MARRUBIUM VULGARE, *Linn.*

Fig.—*Reichb. Ic. Fl. Germ., t.* 1224, *f.* 1; *Eng. Bot.*, 410; *Bentl. and Trim.*, 210. Common White Horehound (*Eng.*), Marrube blanc (*Fr.*).

Hab.—Western Temperate Himalaya to Europe. The herb.

Vernacular.— Farásiyún (*Ind. Bazars*).

History, Uses, &c.—This plant is the πράσιον of Theophrastus (vi., 2), who mentions two kinds. Dioscorides (iii., 110) relates its medicinal uses, which are also noticed by Hippocrates (681, 3), Celsus (v., 11), and Pliny (20, 89). The ancients considered it to be a general stimulant, expectorant, deobstruent, carminative and local anodyne. Horehound has still a considerable reputation in Europe as a remedy for chronic bronchitis with copious expectoration, and as a stomachic tonic in dyspepsia. It was also formerly prescribed in chronic rheumatism, hepatic and uterine obstructions and ague, the usual dose being from ½ to 1 drachm of the dried herb. The ancients used the expressed juice with honey, both internally and as a local application to foul ulcers and diseased mucous surfaces.

Horehound is the Farásiyún of Ibn Sina and other Arabian physicians, who reproduce the account given by Dioscorides of its medicinal uses. Hakim Ali Gilání, in his commentary upon the Kánun, gives Súf-el-ard, "earth wool," and Hashishat-el-kalb, "dogs' herb," as Arabic names for the plant; he says that dogs always piss on smelling it.

Owing to the similarity between the Greek words πράσιον and πράσον some Mahometan physicians have fallen into the error of supposing the drug to be an alliaceous plant. Hakim Muatamid-el-muluk Syud Alvikhán points out this error, but falls into another, inasmuch as he identifies it with Arusa (*Adhatoda Vasica*). Mahometan writers also mention a second kind of Farásiyún called *Balúti*; this is our Black Horehound (*Ballota nigra*, Linn.).

M. vulgare is a common plant in Persia; Aitchison observed it growing abundantly in Khorasan. In the bazars of the plains of India it is not obtainable; if demanded, either Arusa, or a kind of squill called Farásiyún-i-piyázi, is supplied.

Description.—The branching stem is about a foot high, quadrangular, much-branched, and covered with a white felt. The leaves are opposite, petiolate, about an inch long, roundish-ovate, somewhat heart-shaped or rounded at the base, obtuse, serrate or coarsely crenate, wrinkled by the prominent veins below, pale-green and downy above and hoary beneath. The flowers are in dense axillary whorls, with woolly, linear, and hooked bracts, a tubular ten-ribbed calyx divided into ten short, spreading, stiff, and hooked teeth, and a white bilabiate corolla enclosing four stamens. The four achenes are dark-brown.

The herb has a peculiar aromatic and somewhat musky odour and a pungent bitter taste; if kept for any time, the aroma disappears.

Chemical composition.—The plant has been recently examined by J. W. Morrison (*Am. Journ. Pharm.*, 1890, p. 327). A proximate analysis gave the following result:—

	Per cent.
Fat, wax and traces of volatile oil	2·05
Crystalline compound, soluble in ether	·48
Chlorophyl and fat	2·29
Resin and bitter compounds, soluble in absolute alcohol	1·94
Mucilage	4·94
Glucose	·67
Extractive, soluble in water	5·93
Albuminoids	4·48
Pectin and undetermined	5·93
Pararabin	2·30
Cellulose and lignin	37·48
Moisture	6·72
Ash	24 30
Loss	·49

The fat was soluble in hot 95 per cent. alcohol, and melted at 46° C. The wax was insoluble in this solvent, but dissolved in carbon bisulphide. The crystalline principle was extracted from the drug with stronger ether, and purified by repeated crystallization from hot 95 per cent. alcohol, with one or more treatments with animal charcoal. The crystals were insoluble in water and in solution of potassium hydrate, very sparingly soluble in boiling water and in cold alcohol. Soluble in hot 95 per cent. alcohol, also in ether and chloroform. They melted at 152° to 153° C. They were at first tasteless, but developed, when held on the tongue, a decided bitterness. The alcoholic solution was very bitter.

Sulphuric or nitric acid gave a dark-brown colour, hydrochloric acid produced no change and ferric chloride produced no change.

This principle reduced Fehling's solution slightly by boiling, without first being treated with an acid. On boiling it first with acidulated water a peculiar aromatic odour was developed, then on heating with Fehling's solution an abundant precipitate of cuprous oxide was produced, thus showing it to be an easily decomposable glucoside.

A small quantity of a bitter principle was extracted from the drug by absolute alcohol, along with the resin. This appeared to be different from the previous one extracted by ether, and for the purpose of further investigation, a larger quantity of the drug was exhausted with ether, the solvent recovered and the residue treated with petroleum ether to remove fat and wax. The remaining portion was dissolved in hot alcohol, treated with animal charcoal and crystallized. The crystals were purified by repeated crystallization and treatment with animal charcoal. Melting point, 152° to 153° C.

The average of two combustions was:—

	Found.	Calculated for. $(C^{40}H^{58}O^{9})$
C	70·25	70·38
H	8·42	8·50
O	21·33	21·12
	100·00	100·00

Three samples of crystals, presented with a thesis of last year by Frederick G. Hertel, Ph.G. (*American Journal of Pharmacy*, 1890, p. 273), and obtained by him from the fluid extract, were also examined. One of these, which he had crystallized from cold alcohol, melted at 153·5° to 154·5° C., was evidently nearly pure; the average of three combustions gave :—

C	70·54
H	9·08
O	20·38
	100·00

The other samples were evidently the same compound in an impurer condition, as was found by combustion and melting point. The author here remarks:—

"This compound as well as that obtained by myself is evidently the marrubiin discovered by Mein in 1855. Harm (*Archiv der Pharmacie*, No. 83, p. 144) stated the melting point to be 148°C.

"In a later communication (No. 116, page 41), on elementary analysis he found the substance to contain 8·52 per cent. of hydrogen and more than 69 per cent. of carbon.

" Kromayer (*Archiv der Pharmacie,* No. 108, p. 257) gives the yield of marrubiin as about 2 grams from 25 pounds of the drug, and states the melting point to be about 160°C., and that it is not a glucoside. My results indicate its composition to be very close to that of absinthiin, $C^{40}H^{58}O^{9}$, but they do not agree with all the properties of that substance as described by Kromayer in the same journal (No. 108, p. 20), who states that absinthiin melts at 120°to 125° C. Many of the properties, however, are common to both substances, prominent among which are,—solubility, taste, grittiness between the teeth, crystalline appearance and percentage composition."

The larger portion of the drug, after exhaustion with ether, was extracted with methyl alcohol, the solvent recovered, and the residue treated with water and filtered.

The filtrate, on agitation successively with ether and chloroform, yielded to the former a very bitter greenish substance with a narcotic odour, and to the latter a brownish substance with a bitter and pungent taste. Both gave negative results when tested for alkaloids and both reduced Fehling's solution, especially after heating with dilute acid, during which process each developed a peculiar aromatic odour. These results point to the presence of two bitter principles besides marrubiin, which is in agreement with Hertel's statement, that after the separation of marrubiin the fluid extract appeared to be as bitter as before.

Anisomeles malabarica, *Br. Bot. Mag., t.* 2071; *Wight Ic., t.* 164, is well known in Southern India, where it is called Peyameratti in Tamil and Mogbira in Telugu. Rumphius, speaking of the juice of the plant, says:—"Idem quoque succus cum binis guttis olei sesamini propinatus, prodest mirifice asthmaticis, vel tussi mala laborantibus, quem in finem syrupus quoque præparatur ex foliorum succo cum saccharo cocto." (*Hort. Amb. v.*, 8, 65.) It is a native of Malabar, where it is called Karintoomba, and is noticed by Rheede. (*Hort. Mal. x.*, p. 185, *t.* 93.) Wight, Ainslie, and others mention that an infusion of the leaves is given to children in colic, dyspepsia, and fever arising from teething; in ague an infusion of the leaves is used to promote perspiration; a decoction of the plant, or the essential oil distilled from it, is used externally in rheumatism. The plant appears to have medicinal properties very similar to those of Horehound.

Description.—Shrubby, 2 to 5 feet; branches obtuse angled; leaves ovate-lanceolate, crenately serrated at the upper part, entire below, about 5 inches long, and 1½ inch broad; calyx 5-cleft, thickly covered with long white rather viscid pubescence; upper lip of corolla entire, white, under one 3-cleft with the lateral divisions reflexed; anthers deep purple; whorls disposed in simple racemes.

LEUCAS ASPERA, *Spreng.*

Fig.—*Rheede, Hort. Mal. x., t.* 91.

Hab.—Plains of India. The herb.

LEUCAS LINIFOLIA, *Spreng.*

Fig.—*Jacq. Ic. Pl. Rar. i.,* 11, *t.* 111; *Rumph. Herb. Amb. vi., t.* 16, *f.* 1.

Hab.—Plains of India. The herb.

LEUCAS ZEYLANICA, *Br.*

Fig.—*Wight Ill., t.* 176. Herbe Tombée (*Fr.*).

Hab.—Assam to Ceylon. The herb.

LEUCAS CEPHALOTES, *Spreng.*

Fig.—*Wight Ic., t.* 337; *Desf. in Mem. Mus. xi.,* 8, *t.* 4.

Hab.—Himalaya. Plains of N. India and Deccan. The herb.

Vernacular.—Túmba-phúl, Kúmbha-phúl, Bahúphúli (*Mar.*), Goma, Madha-páti (*Hind.*), Tigadi (*Can.*), Kúbo, Kúlán-nú-phúl (*Guz.*), Tumba (*Mal.*), Gul-dora, Chatra (*Punj.*), Halkasa (*Beng.*), Tumi (*Tel.*).

History, Uses, &c.—At least four species of Leucas are used in Hindu medicine under the Sanskrit name of *Drona-pushpi* or "cup-flower," so called from the resemblance of the calyx of these plants to a little cup. The synonyms for these plants are *Kumbha-yoni, Kurumba, Kharva-yattra, Chitra-pattrika, Chitrákshupa* and *Su-pushpa;* they are described in the Nighantas as heavy, dry, sweet, hot, and aperient, generators of wind and bile, and are prescribed for jaundice and to expel phlegmatic humors and worms; they are also considered to be stimulant and diaphoretic.

In the cough or catarrh of children, *Tumba* juice 1 part, with 2 parts of honey and a few grains of Borax, may be mixed, and a few drops given occasionally, and in intestinal catarrh 6 drops of the juice may be given with a little powdered *Khárik* (dry dates).

These plants are also used in Hindu ritual; during the ceremonial bath, early in the morning on the *Naraka Chaturdasi*, or first day of the *Divali*, the religious manuals direct the whirling round the body, while bathing, of a sprig of *Drona-pushpi* of *Achyranthes aspera* (*apámárga*), and of *Cassia Tora* (*prapunáta*), cf. Vol. II., p. 65. The Mahometan physicians have given these plants the name of *Sisáliyús*, and use them as a substitute for the true *Sisáliyús* (*Myrrhis odorata*), as stimulant diaphoretics. Rheede notices the use of *L. aspera* in Malabar, and the same species is given in amenorrhœa at Réunion. Under the name of *Herba admirationis* a species of Leucas, probably *L. linifolia*, is described by Rumphius. In Western India *L. zeylanica* is much used, and in the Punjab *L. cephalotes*. These plants are a popular local application to itch and mange, and the juice of the leaves snuffed up by the nostrils is used as a remedy in snake-bites, and for headache and colds. An infusion is known as an insecticide, and planters and others on the Nilgiris find that blight and insect pests may be kept away from trees by a diligent application of this remedy. The flowers are offered in the Hindu temples. In Réunion *L. zeylanica* is known as *Herbe Tombée*, and is considered to be stimulant and antirheumatic.

Description.—*L. aspera* is annual, erect or diffuse, stem stout, hispid or scabrid, leaves 1 to 3 inches, linear or oblong obtuse, entire or crenate, whorls large, terminal and axillary, bracts long, linear and filiform, calyx ⅓ to ⅔ of an inch, tubular, curved, smooth below, green and ribbed and scabrid above, contracted above the nutlets, mouth small, glabrous, very oblique, shortly and irregularly toothed, flowers small, white. *L. linifolia* and *L. zeylanica* are very similar plants, and *L. cephalotes* has very large terminal and globose whorls of flowers. These plants have an odour recalling that of the Dead-nettle (*Lamium album*), but *L. aspera* is more fragrant than the others.

Chemical composition.—The herb of *L. zeylanica* on distillation afforded a very small quantity of essential oil. By boiling a decoction of the herb with soda solution a strong odour was given off, and on condensing the vapour, ammonia and a volatile alkaloid were detected in the distillate. The alkaloid was combined in the plant with an acid giving a green colour with ferric salts. The air-dried plant afforded 7·3 per cent. of ash.

Leonotis nepetæfolia, *Br. Bot. Reg., t.* 281; *WightIc., t.* 867; *Vern.*—Hejur-chei (*Beng.*), Mátijer, Mátisúl (*Guz.*), Dípmal (*Mar.*), is a large and conspicuous annual common in the neighbourhood of villages throughout the hotter parts of India. It is easily recognised by its globular spinous heads of orange-coloured flowers. Roxburgh gives the following description of the plant:—"Stem annual, straight, four-sided, simple, from 4 to 6 feet high. Leaves opposite, spreading, petioled, cordate, serrate, pointed, downy, from 4 to 8 inches long, and 2 to 3 broad. Floral leaves (*bractes verticillorum*) lanceolate, depending. Petioles channelled, winged with the decurrent leaf; verticels globular, 2, 3 or 4, towards the apex of the plant about 5 inches asunder. Involucres many, subulate. Flowers numerous, of a deep rich orange colour. Calyx, 10-striated, 8-toothed; corol, under lip very short, 3-toothed, at all times of a dirty withered colour."

The ashes of the flower-heads mixed with curds are applied to ringworm and other itchy diseases of the skin. Dr. A. J. Amadeo states that it is called *Rascamoño* in Porto-Rico, and that a decoction of the leaves is used as a tonic, the juice is also expressed and taken with limejuice and rum as a febrifuge. Dr. Amadeo has used it in combination with *Phyllanthus Niruri* in intermittents.

Buliun (πολίον), the Poly-Germander (*Teucrium Polium,* L.), **Iskurdiyun** (σκορδίον), the Water-Germander (*T. Scordium*), and **Kamazariyus** (χαμάιδρυς), the Wall-Germander (*T. Chamædrys*), are treated of in the Materia Medica of the Indian Mahometan physicians, but none of these plants are, as far as our experience goes, obtainable in the bazars, although *T. Scordium* is a native of the Western Himalaya and Cashmere. This plant has an odour of garlic, and is one of the ingredients in the

Tiryák-i-Farúk or *Theriaca Andromachi*, which is still sold in the bazars of India. *T. Polium* is a native of Persia, and was found by Aitchison in Khorasan, but he did not observe that it was used medicinally. He also notices *T. serratum*, Benth., as having a strong odour of asafœtida. *T. Chamædrys* was formerly used in Europe as a remedy for gout, and was an ingredient in the celebrated antiarthritic or Portland powder.

PLANTAGINEÆ.

PLANTAGO OVATA, *Forsk.*

Fig.—*Bentl. and Trim.*, *t.* 211. Syn. *P. Ispaghula.*

Hab.—Punjab, Sind, Persia. The seeds. Spogel seeds (*Eng.*).

Vernacular.—Isbaghol (*Hind.*), Esabgol (*Mar.*), Eshopghol (*Beng.*), Esopgol, Uthamu-jirun (*Guz.*), Ishappukol-virai (*Tam.*), Isapagála-vittulu (*Tel.*), Isabakolu (*Can.*).

History, Uses, &c.—The seeds are not mentioned by the old Hindu writers, but the Guzerathi name appears to be of Sanskrit origin. In all the vernaculars corruptions of the Persian name *Ispaghúl* are in use. This word is a compound of اسپ "a horse," and غول "the ear," in allusion to the shape of the seeds. In Mahometan works the seeds will be found described under the name of *Bazr-i-Katúna.* The author of the *Makhzan* states that *Kaliún* is the Greek, *Isparzah* the Isfaháni, and *Bangúst* and *Shikam-daridah* the Shirazi names for them. In India, they are considered to be cooling and demulcent, and useful in inflammatory and bilious derangements of the digestive organs. The crushed seeds made into a poultice with vinegar and oil are applied to rheumatic and gouty swellings. With the mucilage a cooling lotion for the head is made. Two to three dirhems moistened with hot water and mixed with sugar are given in dysentery and irritation of the intestinal canal to procure an easy stool. The decoction is prescribed in cough. The roasted seeds have an astringent effect, and are useful in irritation of the bowels in children, and in dysentery. The natives have an idea that the powdered seeds are injurious, and consequently always administer them whole. Fleming, Twining, Ainslie, and others speak very favourably of the use of *Ispaghúl* in the treatment of chronic diarrhœa. Twining gives the dose for an adult as 2½ drachms mixed with half a drachm of sugar-candy. (*Diseases of Bengal,* Vol. I., p. 212.) In the *Pharmacopœia of India* the seeds have been made official, and directions are given for the preparation of a decoction.

Description.—The seeds are boat-shaped, about ⅛ of an inch long and rather less than $\frac{1}{16}$ broad, translucent, with a pinkish tinge and a faint brown streak upon the convex side. The concavity is covered with a thin white membrane. Soaked in water they become coated with an abundant adherent mucilage which is free from taste and odour. The epidermis of the seeds is composed of polyhedral cells, the walls of which are thickened by secondary deposits, the source of the mucilage; between it and the albumen is a thin brownish layer. The albumen is formed of thick walled cells which contain granular matter.

P. amplexicaulis, *Cav. Ic. ii., t.* 125, a plant of the Punjab Plains, Malwa and Sind, extending to Southern Europe, furnishes the brown *Ispaghúl* not unfrequently to be met with in the Indian bazars. The seeds have the same boat-shaped form as those of *P. ovata,* but are rather larger, averaging ⅙ of an inch in length. They are probably as efficient as the true Ispaghúl seeds.

Commerce.—Large quantities of these seeds are imported into Bombay from Persia. Value, Rs. 4 per maund of 37½ lbs.

They differ in colour, some being brown and some nearly white with a pinkish tinge; the latter are preferred.

PLANTAGO MAJOR, *Linn.*

Fig.—*Wight Ill., t.* 177; *Eng. Bot.*, 1558. Greater Plantain (*Eng.*), Grand Plantain (*Fr.*).

Hab.—Temperate India, Persia, Europe. The seeds.

Vernacular.—Bártang, Bárhang (*Indian bazars*).

History, Uses, &c.—Under the name of αρνογλωσσον Dioscorides describes two varieties of Plantago, the greater and the lesser, and states that the first is the best and most generally used. These plants were known to the Romans as Plantago, and according to Sibthorp are the *P. lagopus* and *P. altissima* of modern botany; they were considered to be very effectual in arresting the fluxes known by the Greeks as "rheumatismi," or "griping pains in the bowels" (*Plin.* 25, 39; 26, 47). The leaves and roots were considered to be astringent and febrifuge (*Galen*). The Arabian physicians describe them under the name of Lisán-el-hamal, and state that they are the Sabaat-azlaa and Kasrat-el-azlaa of Dioscorides (Arabic translations of ἑπτάπλευρον, and πολύνευρον) meaning '*seven-ribbed and many-ribbed*'; they repeat what the Greeks have written with a few trifling additions. The seeds of *P. major* are largely imported into India from Persia, and have a great reputation as a remedy for dysentery. Valentine Baker states that he was cured by these seeds when suffering from the disease during his travels in Khorasan. The root and leaves are still in use in Europe as domestic remedies on account of their mucilaginous properties.

The seeds of **P. Psyllium**, *Linn.*, a native of the N. W. Punjab, extending to Southern Europe, are used in a similar manner. This plant is often stated to be the source of the Persian Bárhang, but we have always obtained *P. major* by sowing these seeds.

Description.—The seeds are minute, oblong and brown, marked with waved, slightly elevated, longitudinal ridges of a darker colour; one side is arched, the other concave and marked with a scar showing the attachment to the ovary. They are insipid, and have an oily smell when crushed. Soaked in water they become coated with a transparent mucilage.

Chemical composition.—The leaves of *P. major* have been examined chemically by Dr. Rosenbaum, but the results obtained do not indicate any active principle. He found that petroleum benzine extracted 4 per cent. of wax and chlorophyll, the extract fusing at 83° C. Ether dissolved 4·4 per cent. of resin and chlorophyll. Alcohol extracted 10 per cent., of which 6 per cent. was soluble in water and contained a considerable amount of sugar; the remaining four parts were soluble in ammonia. Water took up 13 per cent.,of which 7·2 per cent. was insoluble in 66 per cent. alcohol. Soda solution dissolved 6 per cent., and diluted acid 10 per cent., the latter containing a notable quantity of calcium oxalate. It may be noted here that Th. Koller, in 1868, found citric acid and oxalic acid in the three species, *P. major*, *P. lanceolata*, and *P. media*, besides the ordinary plant constituents, chlorophyll, resin, wax, albumen, and pectin. These constituents do not account for the reputation as a styptic and vulnerary in which the plant was held by ancient writers. The presence of sugar indicates the possibility of a glucoside being contained in the plant. The value of the seeds in diarrhœa and dysentery is no doubt due in some measure to the quantity of mucilage they afford. (*Amer. Journ. Pharm.*, Sept., 1886.)

Plantago mucilage is neutral in reaction, is not altered by iodine or precipitated by borax, alcohol, or perchloride of iron. It is only sparingly soluble in water. R. W. Bauer separated the carbohydrate *xylose* (previously obtained from wood-gum) from the epidermis of *P. Psyllium*, by boiling the aqueous extract with dilute sulphuric acid. It was identified by its melting point, rotatory power, and by its compound with phenylhydrazine. Wood-gum can be obtained from beech wood, jute, or deal, by extracting with 5 per cent. soda and precipitating with alcohol and HCl. When this is hydrolysed, it yields Koch's wood-sugar or xylose. Xylose closely resembles arabinose in all its properties, and, like the latter, is dextrorotatory; when treated with acids, it yields considerable quantities of furfuramide, but no levulose. The phenylosazone has the composition $C^{17}H^{20}N^4O^3$, so that xylose is a penta-glucose $C^5H^{10}O^5$. When treated with nitric acid, it is converted into acids containing 4 or 5 atoms of carbon. Xylose and arabinose, and all substances from which they can be obtained, give the cherry-red coloration of arabin when warmed with phloroglucinol and hydrochloric acid. This reaction can be employed for the detection of xylose and arabinose. (*Journ. Chem. Soc.*, LVI., pp. 233, 847.)

NYCTAGINEÆ.

BOERHAAVIA REPENS, *Linn.*

Fig.—*Delile, Fl. Eg., t.* 3, *f.* 1; *Wight Ic., t.* 874; *Rheede, Hort. Mal. vii., t.* 56. Spreading Hogweed (*Eng.*), Patagon (*Fr.*).

Hab.—Throughout India. The herb and root.

Vernacular.—Sánt, Thikrí (*Hind.*), Purna, Punarnaba (*Beng.*), Khápra, Punanava, Kálivasu, Ghetulí (*Mar.*), Múkku-rattai (*Tam.*), Atíka-mámidi (*Tel.*), Vakha-khaparo, Sátodí-mula (*Guz.*), Ganajali, Biléganjali (*Can.*).

History, Uses, &c.—This plant is called by Sanskrit medical writers Punar-nava, Punar-bhava, and Punar-bhu, on account of its perennial habit, and Sothagni from its use as a remedy for dropsy. It is described in the Nighantas as pungent, dry, hot, sweet and bitter, and is recommended as a laxative, diuretic, and stomachic in jaundice, strangury, dropsy, and internal inflammations. A compound decoction, *Punarnavashtaka*, is made of the roots, dried Neem bark, leaves of *Trichosanthes dioica*, dried ginger, root of *Picrorhiza Kurrooa*, chebulic myrobalans, stem of *Tinospora cordifolia*, and dried wood of *Berberis* (Dárhalad), each one quarter tola, water 32 tolas, boiled down to one-fourth, which is to be taken during the 24 hours. An oil and electuary are also used.

Ainslie mentions the use of the root in powder, in the quantity of a teaspoonful twice daily, as a laxative. In the *Pharmacopœia of India* its successful use as an expectorant in asthma is noticed, and it is said to act as an emetic when given in large doses. This has been confirmed by the experience of the French in the Antilles, where the plant is called *Patagon* or *Patagonelle-Valeriane.* In Western India the herb is used as a diuretic in gonorrhœa, and as an external application the pounded leaves are applied to dropsical swellings. In the rainy season, when luxuriant, it is eaten as a potherb, after having been well boiled to remove its medicinal properties. The use of the root in gonorrhœa appears to have been introduced by the Portuguese; in the West Indies the plant is known as *Bejuco de purgacion,* and is the popular remedy for that disease. A decoction (1 oz. to a pint of water) is used in doses of a wineglassful every hour.

Description.—A common creeping weed on waste ground and roadsides; stalks numerous, about two feet long, slender, procumbent; leaves cordate-ovate, unequal, opposite, edges waved, tinged with red; flowers small, sessile on the apex of the pedicels, peduncles from the axils and ends of the branches; fruit oblong, dull green, or brownish, viscid, about the size of a caraway, longitudinally 5-grooved, studded all over with glandular hairs; root twisted, often as thick as the finger when fresh, whitish, fleshy, 2 to 3-branched, a foot long or more; taste bitterish, nauseous. A microscopic section shows that the parenchyme is loaded with needle-shaped crystals, otherwise there is nothing peculiar.

There are two varieties of the plant, one with white and the other with red flowers; in Bengal the former is called Svetapurna and the latter Gudha-purna.

Chemical composition.—The whole plant was used for the examination, and, with the exception of minute traces of a principle soluble in ether, and affording reactions with alkaloidal reagents, nothing of interest was detected. No principle reacting with ferric salts was present.

MIRABILIS JALAPA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 371; *Rheede, Hort. Mal.x.*, *t.* 75. Marvel of Peru (*Eng.*), Belle de nuit (*Fr.*).

Hab.—West Indies. Cultivated in India. The leaves and root.

Vernacular.—Gul A'bbás (*Pers.*, *Ind.*), Krishna-keli (*Beng.*), Anthinarlu, Patharachi (*Tam.*), Batharachi (*Tel.*), Madhyánhamallige (*Can.*), Antimalari (*Mal.*), Gulbás, Gulbas (*Mar.*).

History, Uses, &c.—Five varieties of this plant, with red, white, yellow, red and white, and red and yellow flowers, were introduced from the West Indies in 1596, and must have been carried by the Portuguese to the East shortly afterwards, as the plant is said to have been introduced into Persia in the reign of Shah Abbas the first, and was established on the Malabar Coast in the time of Van Rheede. It was at one time supposed to produce the Jalap of commerce. *M. Jalapa* has been given the Sanskrit name of Sandhyakali, or "evening flower," but is best known by its Persian name of Gul A'bbas, or "flower of A'bbás"; it is a favorite flower of the Persians, who cultivate it in ornamental flower pots. The Arabs call it Shab-el-leili, which is evidently a translation of the French "belle de nuit"; it is the *Fula quadrohoras*, or "four o'clock flower," of the Portuguese, as its flowers open at that hour in the afternoon.

In India the leaves boiled in water are applied as a maturant to boils and buboes, and the juice, which is considered to be very cooling, is applied to the body to allay the heat and itching in the urticaria arising from dyspepsia; the *U. febrilis* or *U. ab ingestis* of European physicians, which the Hindus consider to be caused by bile in the blood. The seeds are said to be sometimes used to adulterate black pepper. The root is said to be a mild purgative, but Loureiro remarks, "Hæc radix non est apta ad medicinam, nisi per aliquot annos in viva planta senescat; tuncque sit subrotunda, rugosa, exterius subnigra, intus fusco-pallida, circulis concentricis nigricantibus distincta." In the Concan the dried root powdered, and fried in *ghi* with spices, is given with milk as a *paushtik* or strengthening medicine, and rubbed down with water to a paste it is applied to contusions.

Dr. P. S. Mootooswamy (*Ind. Med. Gaz.*,Oct. 1889) states that in Tanjore the roots boiled and made into curry are considered beneficial to those who suffer from piles, and that a powder and confection are also in use. The powder contains five drachms of root, two and a half each of long and black pepper, and five ounces of sugar. Dose ʒi, twice daily. The confection has the same quantity of root with 2½ drachms each of nutmeg, mace, and Atis root, *ghi* 1 oz., sugar and milk of each 10 ounces. Dose as above.

Dr. Mootooswamy finds the root to act as an astringent in these preparations. Ainslie, quoting Fleming (*Cat.*, p. 29), states that the root was tried as a purgative by Drs. Hunter and Shoolbred, but found to have so feeble a purgative action as to be useless. He also tried it himself with the same result. According to Thunberg, the Japanese prepare a kind of white paint for their complexions from the seeds.

Description.—The root of young plants is cylindrical above and tapering below, but in old plants it becomes napiform or subrotund, the external surface is dark brown and marked with numerous circular rings; internally it is dirty white or greyish. When dry, very old roots become hard, compact and heavy, and deepen in colour, but younger roots are of a leathery consistence. It has a faintly nauseous odour, and a sweetish, subacrid taste. A transverse section of the root shows numerous concentric rings of a darker colour than the intervening substance; it shows numerous acicular crystals when magnified.

Chemical composition.—The roots were collected in July, cut into slices, and exposed to warm air, then reduced to powder and the desiccation completed at 100° C.

The fresh roots dried over sulphuric acid lost 81·136 per cent. in weight; the ash amounted to 6·135 per cent., and was free from manganese.

The proximate analysis was made with the powdered roots dried at 100° C., and was conducted according to Dragendorff's plan with the following results:—

Light petroleum ether extract		0·580 per cent.
Ether extract, soluble in water	0·09 per cent.	
alcohol	0·222 „	
Residue insoluble in water or alcohol	0·028 „	0·340 „
Absolute alcohol extract		3·040 „
Aqueous extract containing glucose 1·6 per cent., saccharose or allied carbohydrate 7·97 per cent.		30·62 „

The petroleum ether extractive was soft and pale yellowish in colour, non-crystalline, and without any special odour. It consisted of wax, and a pale yellow oil, soluble in absolute alcohol with neutral reaction.

The ethereal extract was soft and yellowish. The portion soluble in water had an acid reaction, but gave no coloration with ferric chloride. Acidulated with sulphuric acid a slight precipitate was afforded with Mayer's reagent. The residue of the ethereal extract soluble in alcohol was also yellowish, soft' and on standing became indistinctly crystalline. Treated with water acidulated with sulphuric acid it gave no alkaloidal reactions; with alkalies on gently warming it was slightly soluble, with pale yellow coloration: the colour being destroyed by acids, and whitish flocks precipitated.

The alcoholic tincture of the roots was of a port-wine colour, and the extract of a deep orange tint. In water part was soluble with acid reaction, and afforded a precipitate with alkaloidal reagents. The extract was treated with ammonia, in which the greater part dissolved, affording a dirty brownish-red solution, and the solution agitated with ether: the ethereal extract amounted to 0·384 per cent. and contained a small amount of alkaloid with much colouring matter. An attempt was made to purify the alkaloid by reagitating this extract from an acid solution with ether, and then neutralizing and again agitating with ether; an unweighable amount of the alkaloid was, however, obtained. No special colour reactions of the alkaloid were noted. An alkaline solution of the alcoholic extract was only slightly precipitated by acids, the solution remaining dark-coloured. The aqueous extract contained 1·6 per cent. of glucose calculated on the roots dried at 100°C. After boiling with dilute sulphuric acid a second determination with Fehling's solution was made, and the result calculated as saccharose, which was equivalent to 7·97 per cent.

In order to determine whether the plant had any injurious properties, the alcoholic extract from 10 grams of the dried and pounded roots was mixed with a few drops of ammonia and water and injected into a cat's stomach; the cat vomited once, but was not otherwise inconvenienced.

AMARANTACEÆ.

ACHYRANTHES ASPERA, *Linn.*

Fig.—*Wight Ic.*, *t.* 1780. Prickly Chaff-flower (*Eng.*).

Hab.—Throughout India and tropical Asia. The herb.

Vernacular.—Unga, Latchira, Chirchira (*Hind.*), Apang (*Beng.*)., Pándhara-ághada, Ághada (*Mar.*), Sufed-ághado (*Guz.*), Na-yurivi (*Tam.*), Uttareni, Antisha (*Tel.*), Uttaráni, Uttaréni (*Can.*), Kataláti (*Mal.*).

History, Uses, &c.—This plant has given a name to the sacrificial offering called *Apamarga Homa*, which consisted of a handful of the flour of the seeds offered at daybreak, but which is not now, as far as we know, practised in India. According to the Black Yajurveda, Indra, having killed Vritra and other demons, was overcome by Namuchi and made peace with him, promising never to kill him with any solid or liquid, neither by day nor by night. But Indra collected some foam, which is neither solid nor liquid, and killed Nàmuchi in the morning between night and daybreak. From the head of the demon sprung the herb Apamarga, with the assistance of which Indra was able to kill all demons. Hence this plant has the reputation of being a powerful talisman, and is now popularly supposed to act as a safeguard against scorpions and snakes by paralysing them.* It is waved round the body whilst taking the ceremonial bath early in the morning on the Naraka Chaturdasi or first day of the Diváli (new year) festival.

The Sanskrit synonyms for the plant are Shikhari, Kini or Kinihi, Khara-manjari "having a rough flower-stalk," Adhvashalya "roadside rice," Shaikharika, Pratyak-pushpi "having reverted flowers," and Mayuraka "crested." It is described in the Nighantas as purgative, pungent, digestive; a remedy for phlegm, wind, inflammation of the internal organs, piles, itch, abdominal enlargements, and enlarged cervical glands. The ashes are used by the Hindus in preparing caustic alkaline preparations. The diuretic properties of the plant are well known to the natives of India, and European physicians agree as to its value in dropsical affections; one ounce of the plant may be boiled in ten ounces of water for 15 minutes, and from 1 to 2 ounces of the decoction be given 3 times a day. (*Pharm. of India*, p. 184.)

Different parts of the plant are ingredients in many native prescriptions in combination with more active remedies.

In Western India the juice is applied to relieve toothache. The ashes with honey are given to relieve cough; the root in doses of one tolá is given at bedtime for night blindness, and rubbed into a paste with water it is used as an *anjan* (eye salve) in opacities of the cornea. The seeds are often used as a famine food in India, especially in Rájputana, where the plant is called Bharotha, भरोटा (grass).

Description.—A common weed, with an erect, striated pubescent stem, generally about two feet high, but sometimes much more. Side branches in pairs, spreading; leaves pubescent from the presence of a thick coat of long simple hairs, obovate, undulated, very obtuse, acuminated, base attenuated; petiole short; spikes long, lax; flowers green; bracts rigid, prickly. Sections of the stem do not show any crystalline deposit in the parenchyma. The seeds are oblong, of a brown colour, from $\frac{1}{10}$ to $\frac{1}{8}$ of an inch in length; on one side a grooved prominence is seen which indicates the position of the embryo where it curves round the mealy albumen. The starch granules are very small, and are so closely packed that the large irregular-shaped cells which contain them have almost the appearance of parenchymatous cells.

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* Compare with Scribonius Comp. 163, 164, where similar superstitions are recorded.

Chemical composition.—The whole plant collected in August was used. A proximate analysis failed to indicate the presence of any principle of special interest. No alkaloidal body was detected, and the alcoholic extract contained no principle reacting with ferric salts.

For the ash determination, the roots, stems and leaves were separately examined with the following results:—

	Leaves.	Stems.	Roots.
P^2O^5	3·0257	2·6939	1·8594
SiO^2 as Sand ...	39·7192	12·9716	21·4219
SO^3	1·3200	2·6534	3·9523
CaO........... .	13·8893	13·1233	12·9335
MgO	3·4778	3·5149	5·4419
K^2O..............	17·8454	32·0008	28·5830
Na^2O	......	......	·9860
Fe^2O^3	2·7931	3·0352	5 6297
Manganese	Traces, not estimated.	Not estimated.	Not estimated.
KCl..............	5·7416	9·5221	......
NaCl	1·1770	1·5261	3·2951
Al^2O^3	2·0651	Not estimated.	Not estimated.
CO^2..............	8·8687	13·6294	11·0057
Carbon	·3297	·5525	Not estimated.
	100·2526	95·2232	95·1085

The leaves, stems, and roots dried at 100°C. afforded respectively the following percentages of ash:—Leaves, 24·334; stems, 8·672; roots, 8·863. The large amount of sand present in the ash is due to the fact of the plants having been collected during the rains, and when received they were coated with finely divided silicious matter.

The total potash calculated as K^2O was equivalent in the leaves to 21·4986 per cent., in the stems to 38·0122 per cent., and in the roots to 28·5830 per cent. It is possible that the plant might be of value as a cheap green manure on account of its potash content. (*Warden, Chem. News*, Vol. ii., 1891).

Amarantus spinosus, *Linn.*, *Willd. Amar.* 38, *t.* 4, *f.* 8; *Vern.*—Tanduliya (*Sans.*), Kántemáth (*Bomb.*), Kántanatia (*Beng.*), Mulluk-kirai (*Tam.*), Kántálo-dambho (*Guz.*), possesses mucilaginous properties. The Hindu physicians prescribe the root in combination with other drugs in menorrhagia. It is considered to be a specific for colic. A poultice of the leaves was officinal in the *Bengal Pharmacopœia*.

The authors of the *Pharmacopœia of India* regard the plant as a simple emollient, and inferior to many others, but recently the root has been found to be of great service in the treatment of gonorrhœa and eczema. In gonorrhœa it is said to stop the muco-purulent discharge, and all the concomitant symptoms, such as heat, scalding and general irritation.

ÆRUA JAVANICA, *Juss.*

Fig.—*Wight Ic.*, *t.* 876.

Hab.—Plains of India. The herb.

ÆRUA LANATA, *Juss.*

Fig.—*Wight Ic.*, *t.* 723; *Rheede, Hort. Mal.* *x.*, *t.* 29.

Hab.—Plains of India. The herb.

Vernacular.—Chaya (*Hind.*, *Beng.*), Bhui-kallán (*Punj.*), Kumra-pindi, Kapur-madhura, Kapur-phuti (*Mar.*), Pindiconda, Kamiupulai, Nilapulai (*Tel.*), Pulai, Sirru-pulai (*Tam.*).

History, Uses, &c.—These plants are used by the natives of India as diuretics, and are considered to be of great value in lithiasis; they are also thought to be antidotal in cases of poisoning by arsenic. The flowers are sold in the bazars of Northern India under the name of Bhui-kallán. *Æ. lanata* is the Scherubala of Rheede, and Ainslie states that the Vytians consider the root to be demulcent and prescribe a decoction in strangury; in the Concan it is used as a diuretic. *Æ. javanica* has a great reputation in Hyderabad, Deccan, as a remedy for lithiasis, and the flowers have been brought to us for identification by the medical attendant of a gentleman in Bombay, who had been in the habit of obtaining them from Hyderabad under the Marathi name of Kumra-pindi, which is equivalent to the Telingi Pindi-conda, and signifies "cock's *pinda*"; we were informed that much benefit had been derived from their use. These plants resemble *Achyranthes aspera* in their medicinal properties. The flowers are very soft and woolly, and are used for stuffing pillows and mattresses in Sind and in Egypt. In Southern India the natives use the flowering spikes during the Pongul festival for decorating their houses.

Description.—The plants have a white tomentose appearance. The leaves are alternate. The minute flowers are in dense terminal or axillary spikes, those of *Æ. javanica* being much the largest, often 4 to 5 inches in length; they are hermaphrodite, with three concave persistent bracts. The calyx consists of five, nearly equal, erect and hairy sepals; the five stamens are united into a cup at their base; the ovary is one-celled, with a single ovule in each cell. The fruit is a roundish utricle.

CELOSIA ARGENTEA, *Linn.*

Fig.—*Wight Ic., t.* 1767; *Rheede, Hort. Mal. x., t.* 38, 39.

Hab.—Throughout India and tropical Asia. The seeds.

Vernacular.—Sarwáli, Sufédmurgha (*Hind.*), Svet-murga (*Beng.*), Lápadi (*Guz.*), Kurdu (*Mar.*), Gurugu (*Tel.*), Goraji (*Can.*)

History, Uses, &c.—This common annual plant is considered by some to be the Vitunna of Sanskrit writers; when young and tender it is eaten as a vegetable, but is considered to be very heating. The seeds are considered an efficacious remedy in diarrhœa. Indian Mahometan writers on Materia Medica have adopted Sarwáli as a substitute for the βρεταννικη of Dioscorides, and the Herba Britannica of Pliny, which has been identified by Prof. Muntingius of Groningen as *Rumex Hydrolapathum*, Huds., our Water Dock, the Patience aquatique of the French, and Wasserampfer of the Germans. The author of the *Muffaridat-i-Nasiri* states that 180 grains of the seeds, with an equal quantity of sugar-candy, taken daily in a cup of milk, is a most powerful aphrodisiac.

Dr. Watt (*Dict. Econ. Prod. Ind.*, ii, 240) states, on the authority of the Rev. A. Campbell, that the Santals extract a medicinal oil from the seeds.

Description.—Stem 1 to 3 feet, stout or slender, simple or branched; leaves 1 to 6 inches, narrow; spikes solitary, few or many, 1 to 8 by ¾ to 1 inch; peduncle slender; flowers white, tipped with pink, glistening; bracts much shorter than the acute sepals. Seeds lenticular, brown, polished, $\frac{1}{16}$ of an inch in diameter.

Chemical composition.—The following is an analysis of the finely powdered seeds:—

Oil	6·76
Resin, soluble in ether	·81
Alcoholic extract	1·94
Water extract	24·70
Starch, &c.	37·96
Fibre	11·23
Ash	5·80
Moisture	10·80
	100·00

The alcoholic extract contained an alkaloidal principle precipitable by alkalies, soluble in ether, and giving a rose colour with strong sulphuric acid.

CHENOPODIACEÆ.

USHNAN.

GENERA.—**Arthrocnemum, Caroxylon, Salicornia, Salsola, Suæda.** Soda plants.

History, Uses, &c.—Sarjikákshára has doubtless been prepared in India, as it is at the present time, from a very early date. In the time of Pliny a mineral alkali appears to have been prepared in Egypt from the ashes of certain plants and to have been known as Natrum, or in Greek νίτρον (*Plin.* 31, 10), and Strabo, as cited by Beckman, mentions an alkaline water in Armenia used for washing clothes. (*Hist. of Invent.* iii., p. 233.) The plants from which Barilla was prepared were known to the Greeks as τό ἅλιμον or salt-worts. (*Theophr.* H. P. iv., 20; *Diosc.* i., 105.) The Arabs also were early acquainted with the same substance, which seems to have been sometimes potash, or a mixture of soda and potash in various proportions, and to which they gave the name of القلى El-kali or alkali. The Arabian writers describe Ushnán as good for the mange or scab, and the itch; clearing to the complexion, cleansing, emmenagogue and abortive, and a substance with which clothes and the hands are washed. The author of the *Makhzan*, speaking of Ushnán, states that it is a name applied to several plants, one of which has slender branches instead of leaves, upon which knob-like bodies form (*Suæda fruticosa?*). This plant is always fresh and juicy, and is a large herb with round woody stems. He then describes the manner in which the plant is burned in a pit in the ground, and the Kali or Barilla extracted from the ashes. After this he mentions another plant with reddish stems and leaves purplish on one side and green on the other (*Chenopodium atriplicis ?*), yielding a juice which stains black; this plant he says is very common in Sind and Múltan, and is used for staining the black pattern on the Sind pottery. Lastly, he mentions a plant called Khurú-el-'asáfir (sparrow's dung) with white leaves (*Chenopodium album ?*), and another which is called in Persia Ghásool, and is used for dissolving lac dye, and as a substitute for ink, Dr. Watt, in the *Dictionary of the Economic Products of India,* gives the following list of plants which are used in the manufacture of Sajji-khar or Barilla:—

Arthrocnemum indicum, *Moq.*
Caroxylon fœtidum, *Moq.*
,, **Griffithii,** *Moq.*
Salicornia brachiata, *Roxb.*
Salsola Kali, *Willd.*
Suæda fruticosa, *Forsk.*
,, **indica,** *Moq.*
,, **nudiflora,** *Moq.*

Aitchison states that the name Ishlan (probably a mispronunciation of Ushnán) is applied in the Hari-rud Valley to *Anabasis erispoda,* Benth. et Hook. f., which is used in preparing barilla. In the *Report on Punjab Products,* it is stated that the plants are cut down during the cold months, dried and burnt in a pit of a hemispherical shape, about six feet in circumference and three deep, at the bottom of which one or more inverted earthen pots, having small holes in their bottoms, are sunk. The holes are kept closed at first, but when the alkali begins to run, they are cleared to allow it to fill the pots; when cool it forms a porous mass of a greyish-white colour, consisting of carbonates of soda and potash, sulphate of soda, and organic matter. In native practice this substance is prescribed like our preparations of the caustic alkalies. It is the Sarjikákshára of the Rája Nirghanta and the Sájji of the bazars.

SHUKAI.

Hab.—Persia. The herb.

Vernacular.—Shukai (*Ind. Bazars*).

History, Uses, &c.—This drug is described in Mahometan works as the Akraníkí* or Afsharníkí of the Greeks. Other Arabic names given are Shaukat-el-baida, Shaukat-el-Arabiya, and Kathir-el-rakab. Ibn Sina says it is the same as Bázaward (Bádaward, *Pers.*) Muhammad Husain very truly denies this; he says the Persian names are Charchah and Kangarkhár, and describes two varieties, one with a white flower and more slender stems than the other, which has purple flowers, and is the kind generally used. The latter, he says, has triangular stems, the size of a man's finger or less, and thick, small, triangular, downy leaves terminating in thorns; the seeds are small, triangular, and of a greyish colour. The whole drug is of a yellowish white colour and sweetish taste. The plant and fruit are generally used, but the root is to be preferred. Shukai is more drying and astringent than Bádaward; it is attenuant and deobstruent, &c., &c. (*Makhzan-el-Adwiya*, article *Shukai*) Haji Zein-el-Attar states that it is useful in palsy and other diseases caused by cold humors. He quotes Galen as recommending its use in melancholia, and Paulus as saying that it is useful in leprosy. In Persia it is said to have a reputation as a remedy for ague. The dose is from 2 to 5 dirhams.

Description.—The drug as met with in India consists of all parts of the plant broken up, but very little of the root is present. The portions of the stem are of a greenish-yellow colour, round, crooked, channelled, with numerous branches springing from the axils of the leaves; the external surface of the stem is siliceous, hard, and pubescent; internally it is full of soft pith. The petioles of the leaves are stem-clasping, the lower ones completely so. The lower leaves are of considerable

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* Possibly from ἀκρώνυχος, on account of its thick leaves, each lobe of which terminates in a thorn.

size with a triangular midrib, channelled on the upper surface, and short, thick, spinous lobes which vary much in shape. The plant has a gummy, rather disagreeable taste. The fruit is occasionally found mixed with the drug in considerable quantity. It is a woody nut, ¼ of an inch long, formed by the fusing together of the different parts of the perianth and ovary, somewhat triangular in form; at the base are spines formed by the calycine segments; at the apex the perianth forms a number of tooth-like processes which surround the top of the ovary. The seed is ovoid, horny, and has a terebinthinate odour.

Chemical composition.—The chopped plant, air-dried, was treated for several days with warm 80 per cent. spirit, the resulting tincture distilled to remove alcohol, and the residue finally deprived of the last traces of alcohol by spontaneous evaporation. The extract was then mixed with water acidulated with sulphuric acid and agitated with petroleum ether. The petroleum ether extract was greenish, soft, with a camphoraceous and peppermint odour and taste. Treated with warm proof spirit a portion dissolved, forming a clear yellowish liquid while warm, but from which resinoid matter separated on cooling. The solution had a strongly acid reaction and gave a greenish coloration with ferric chloride. After the addition of sulphuric acid, it afforded a very marked precipitate with Mayer's and other alkaloidal reagents. With alkalies the solution was coloured of a bright yellow hue; basic acetate of lead gave a bright yellow precipitate, a similar precipitate, but smaller in amount, being also afforded by lead acetate. The soft resinous residue insoluble in proof spirit, after standing deposited a small amount of bright yellow matter which was destitute of crystalline structure on microscopic examination. In ammonia the residue was insoluble.

During agitation of the extract with petroleum ether a considerable amount of dark, soft resin separated; this resin had a marked peppermint odour, and was only partly soluble in ether. After repeated washing with ether, it was left as a dark, soft mass which could be kneaded by the fingers; on drying at 100°C. a nearly black brittle mass was left, easily pulverised and forming a dark olive-brown coloured powder, odourless and tasteless, but bitter in an alcoholic solution, soluble in ammonia, forming a deep yellowish brown solution, from which it was reprecipitated by acids in dirty yellowish white flocks. In alcohol the resin was easily soluble with acid reaction; with ferric chloride the alcoholic solution was slightly darkened in tint.

After agitation with petroleum ether the acid aqueous solution was agitated with ether: the ether extract was small in quantity, and though some small points separated on the sides of the dish which appeared crystalline on naked-eye inspection, on microscopic examination no crystalline forms were visible. In water the extract was partly soluble with strong acid reaction: the aqueous solution gave with ferric chloride a dirty bluish-green precipitate, changing almost instantly to dirty whitish-brown. With alkalies a bright yellow coloration was afforded; the solution did not precipitate gelatine and gave no reaction with cyanide of potassium. The ether extract was treated with ammonia, in which, with the exception of some flocks, it appeared to be wholly soluble. The solution exhibited a marked greenish fluorescence; it was agitated with ether. The ether extractive formed a non-crystalline yellow varnish, soluble in alcohol without fluorescence, with a very bitter taste and neutral reaction; treated with dilute sulphuric acid a small portion dissolved, and the solution afforded marked reactions with all alkaloidal reagents. The alkaline aqueous solution was acidulated, which caused whitish flocks to separate, and agitated with ether. The ether extract was a non-crystalline yellow varnish, partly soluble in water with strong acid reaction, the solution affording similar reactions to the original aqueous solution of the ether extract. The ammoniacal solution exhibited a greenish fluorescence.

The original aqueous acid solution was now rendered alkaline and reagitated with ether; a yellow varnish was obtained after spontaneous evaporation of the ether. The extract was treated with dilute sulphuric acid and agitated with ether, the ether separated, the aqueous solution rendered alkaline, and again agitated with ether, in order to purify any alkaloidal principle which might be present. The purified ether extract dried to a yellow varnish; the solution in sulphuric acid gave a very marked yellowish precipitate with Mayer's reagent; a white precipitate with alkalies; with Fröhde's reagent, a precipitate first yellowish, rapidly changing to pale blue, and darkening, on standing or warming, to deep prussian blue; chromate of potash gave a yellow precipitate; bichromate of potash and concentrated sulphuric acid, a dirty orange-red; ferric chloride no reaction; the solution was destitute of any bitter taste. Considerable loss of alkaloid occurred during its purification, as the sulphate was somewhat soluble in ether.

Finally the original alkaline aqueous solution was acidulated with sulphuric acid, and agitated with amylic alcohol. On evaporating off the amylic alcohol, a deep orange-red varnish was left, partly soluble in water with strong acid reaction, the solution giving an olive-brown coloration with ferric chloride; no precipitate with gelatine; a bright yellow coloration with alkalies; a bright yellow precipitate with basic acetate of lead; and it reduced Fehling's solution on boiling. The residue, insoluble in water, was dissolved by ammonia, forming a deep orange-yellow solution from which acids afforded a whitish precipitate, the yellow colour being destroyed.

SPINACIA OLERACEA, *Linn.*

Fig.—*Lamk. Encycl., t.* 814; *Wight Ic., t.* 818. Spinach (*Eng.*), Epinard (*Fr.*). Syn. *S. tetrandra,* Stev.

Hab.—Persia. Cultivated in India. The herb and fruit.

Vernacular.—Pálak (*Hind.*), Pálang (*Beng.*), Vusayley-keeray (*Tam.*).

History, Uses, &c.—This potherb is a native of Persia; it is described in the Persian *Burhán* under the name of اسپناخ (ispanákh) as a potherb much used in broth. The name is now often incorrectly pronounced *Ispanáj* by the Persians, and *Isfanáj* or *Isfánáj* by the Arabs. The plant has been introduced into India by the Mahometans, and is now cultivated in many parts of the country. The African Moors brought it to Spain, whence its use gradually spread to other parts of Europe. It was known in England as *Spinach* in 1568, and is noticed in *Turner's Herbal,* published in that year, as "lately introduced and not much in use." Aitchison, in his *Botany of the Afghan Delimitation Commission,* remarks that it grows profusely in the vicinity of Simkoh in the Badghis, and is collected as a potherb by the natives. He says:—"I have no doubt Mr. De Candolle is correct in assuming *S. tetrandra* to be the wild form of *S. oleracea.*" Spinach is much valued by the Mahometans on account of its cooling and emollient properties, and the seeds are sold in all the Indian bazars. A decoction of the plant is prescribed in febrile affections, in lithiasis, and in inflammation of the lungs or bowels. The juice of the leaves is also used as a diuretic and as a gargle in sore-throat. Poultices of the leaves or boiled seeds are applied to soften tumours and promote the maturation of boils. The herb is considered one of the most digestible and wholesome of vegetables.

Description.—The plant has large, thick, succulent, deep-green leaves, of a somewhat triangular form, produced on long foot stalks. The stem is erect, large, round and hollow, about two feet high. The male plants are distinguished by their long terminal spikes of green flowers, while those of the females are axillary, sessile and clustered. The fruit is prickly in some varieties and smooth in others.

Chemical composition.—Besides a large quantity of mucilage spinach contains so large a proportion of nitrates, that the water in which it has been boiled may be used for making touch-paper. The following figures give the mean percentage composition of three samples of spinach recorded by König:—

Water	88·47
Nitrogenous matter	3·49
Fat	0·58
Sugar	0·10
Nitrogen-free extractive	4·34
Fibre	0·93
Ash	2·09

Anhydrous spinach contained, as the mean of three analyses of different samples,—

Nitrogen	4·94
Carbohydrates	37·93

Basella alba, *Linn.*, *Wight Ic.*, *t.* 896, is known ~~as Indian~~ spinach, or Malabar Nightshade, and the juice of the leaves, which is demulcent and cooling, is a popular application to allay the heat and itching of urticaria arising from dyspepsia, an affection which the Hindus consider to be indicative of bile in the blood. The boiled leaves are also used as a poultice. This herb is extensively cultivated as a vegetable, and bears the vernacular names of Poi (*Hind.*), Mayál (*Mar.*), Vasala (*Tam.*), Bachchali (*Tel.*), and Bili-basale (*Can.*). The generic name is derived from the Tamil. The Sanskrit name is Potaki or Upodika.

Many plants of this order are used as potherbs in the East. In Persia and Biluchistan, **Chenopodium Botrys,** *Linn.*, **C. Blitum,** *Hook. f.*, and **Atriplex Moneta,** *Bunge*, are much used. On the Indian coasts, **Arthocnemum indicum,** *Moq.*, a plant of the salt marshes, is used as a vegetable, and is also pickled. Fryer, who visited Bombay in 1694, calls it "samphire."

Plants more generally known as vegetables are **Chenopodium album,** *Linn.*, **C. ambrosioides,** *Linn.*, **Beta vulgaris,** *Linn.*, and **Atriplex hortensis,** *Linn.* The seeds of the Beet are sold in Indian Bazars for medicinal use, under the name of Chukandar.

POLYGONACEÆ.

POLYGONUM AVICULARE, *Linn.*

Fig.—*Eng. Bot.*, 1252. Knot-grass (*Eng.*), Renouée des oiseaux (*Fr.*).

Hab.—Northern Asia, Europe. Introduced into India. The root and seeds.

Vernacular.—Machoti, Bijband, Kesri (*Hind.*), Endráni (*Sind.*)

History, Uses, &c.—This plant is identified by Fée with the male πολύγονον of Dioscorides, a vulnerary and astringent herb, the Polygonos of Pliny (27, 91). It was used by the ancients to arrest hemorrhage, the seeds were considered to be laxative and diuretic and to arrest defluxions. For burning pains in the stomach the leaves were applied topically, and were used in the form of a liniment for pains in the bladder and for erysipelas. The juice was administered in fevers, tertian and quartan more particularly, in doses of two cyathi, just before the paroxysms. Scribonius (*Comp.* 46) says that it received its name "polygonos" from its being found everywhere. Ibn Sina and other Arabian physicians call the plant A'sa'r-ra'i (عصا الراعی) and Batbát (بطباط); they consider it to be cold and dry, and reproduce what the Greeks have said concerning its medicinal uses. The Persians call it Hazàr-bandak. It is the *Polygonum mas* of Matthiolus (*Valgr.* ii., 300).

In India the plant is still used by the Hakims in the diseases named by Dioscorides.

In our own times Polygonum root has been used as a febrifuge in Algeria, and has been reported upon as being an excellent remedy for chronic diarrhœa and stone in the bladder. Its value has apparently been much exaggerated. (*J. R. Jackson, Amer. Journ. Pharm.*, 1873, 247.)

In the *Lancet* (1885, 658) it is said to be used in Russia, under the name of *Homeriana,* as a popular remedy in lung affections. Dr. Rotschinin, who has experimented with the drug, found it really valuable in several cases of bronchitis, two of which were capillary; also in three cases of whooping cough. It was tried in phthisis, but no definitely satisfactory results were obtained. A tumblerful of the decoction was given three times a day.

Description.—Root fibrous, long, very tough, and somewhat woody; branched below, simple at the crown. Stems several, spreading in every direction, generally prostrate, much branched, round, striated, leafy at the numerous knots or joints. Leaves alternate, stalked, hardly an inch long, elliptic or lanceolate, entire, obtuse, single-ribbed, smooth except at the margin, tapering at the base, very variable in width, substance rather coriaceous, colour greyish or glaucous. Flowers variegated with white, crimson and green. Seeds acutely triangular, of a shining black.

Polygonum Bistorta, *Linn.*, is the *Anjubár* of the Western Arabs, and their description of it is still reproduced in Indian medical works. **P. viviparum,** *Linn.*, a nearly allied species, is used as a substitute for it in the Punjab, under the same Arabic name, and is called in the vernacular Maslun and Bilauri. The **Anjubar-i-Rumi** of the bazars, imported from Persia, is a thick reddish-brown astringent root-bark, evidently obtained from a tree or shrub of some size, and it may be observed that Aitchison found an arboreous species of Polygonum growing in the Badghis and Paropamisus.

Other species of Polygonum which have been used medicinally, and which occur in India, are:—

P. glabrum, *Willd.*, **P. Hydropiper,** *Linn.*, **P. molle,** *Don.*, **P. barbatum,** *Linn.*, and **P. alatum,** *Ham.* All these plants are astringent, but *P. Hydropiper* also contains a pungent volatile principle having acrid properties.

Chemical composition.—Dr. C. J. Rademaker (*Amer. Journ. Pharm.*, Nov. 1879) separated from *P. Hydropiper* a crystalline principle which he named *Polygonic acid.* H. Trimble and H. J. Schuchard (*Amer. Journ. Pharm.*, Jan. 1885) re-examined the plant with the following results:—They found that the peculiar pungent principle, although present in a weak alcoholic tincture, disappeared on distillation, the pungent taste of the herb being absent both from the distillate and the residue in the retort.

From these experiments they conclude that the active principle is decomposed on the slightest heating, and that the only proper preparation of the drug would be one made without the application of heat. They prepared the polygonic acid of Dr. Rademaker, and conclude from their experiments that it is only a mixture of impure tannic and gallic acids.

The following summary shows the amount of the most important constituents :—

	Per cent.	
Water	10·25	
Wax	2·70	From petroleum spirit solution.
Resin and chlorophyll	1·54	From ether solution.
Resin, tannin, and chlorophyll.	5·14	From alcoholic solution.
Sugar	1·44	From aqueous solution.
Gum	·55	
Tannin and extractive	5·23	
Albuminoids	1·00	From alkaline solution.
Phlohaphene, &c.	5·95	
Salts and a small amount of extractive	6·00	From dilute acid solution.
Cellulose	57·45	
	97·25	

Separately determined : tannin, 3·46 per cent. ; ash, 7·40 per cent. (*Year-Book of Pharm.*, 1885, p. 160.)

Dr. C. J. Rademaker (*Amer. Journ. Pharm.*, June 1886) re-asserted the existence in this plant of the active crystalline principle, described by him as polygonic acid, and supplied further details respecting its extraction and properties, together with a wood-cut illustration of its crystals. He says :— "Polygonic acid may be prepared by treating the plant with water, to which some bicarbonate of sodium has been added, and allowing it to macerate for 24 hours; or by precipitating a fluid extract with basic acetate of lead. In each case separate the base by means of sulphuric acid, and the organic acid by means of ether. Allow the ethereal solution to evaporate, and treat the residue with distilled water, and filter; this separates the resin (resinous acid). The filtrate is then filtered through animal charcoal repeatedly, until all colouring matter is removed. The filtrate is next treated with solution of gelatine, in order to remove any tannic acid that might be present, again filtered, and evaporated to dryness, redissolved in ether, and the ethereal solution allowed to evaporate spontaneously. Polygonic acid thus prepared crystallizes in needles. Its solution in water does not precipitate gelatine nor produce a bluish-green coloration when added to a mixture of ferrous and ferric salts in solution, showing absence both of gallic and tannic acids. It is freely soluble in water, less so in ether, and insoluble in petroleum spirit. The heat of a water-bath does not destroy any of its properties. (*Year-Book of Pharm.*, 1886, p. 210.)

The other species of Polygonum which have been examined contain starch and tannic and gallic acids. Bowman (1869) obtained 21 per cent. of tannic acid from Bistort root. In the Bengal Chemical Examiner's Report for 1884 we meet with the following notice of *P. glabrum*: "Several specimens of a plant called *Bish-kurki* were sent from Cachar for examination. It was stated that the plant was frequently added to country spirit, which it was believed might have thus communicated to it some specially noxious property. The plant was identified by Dr. G. King as *Polygonum glabrum,* and on chemical examination and physiological application was not found to possess toxic properties."

RHEUM OFFICINALE, *Baillon.*

Fig.—*Bentl. and Trim., t.* 213. Rhubarb (*Eng.*), Rhubarbe (*Fr.*).

Hab.—South-Eastern Tibet, China. The root.

RHEUM PALMATUM, *Linn.*

Fig.—*Bentl. and Trim., t.* 214. Rhubarb (*Eng.*), Rhubarbe (*Fr.*).

Hab.—South-Eastern Tibet, China. The root.

Vernacular.—Rewand-chini, Lakri-rewand-chini (*Ind. Bazars*).

History, Uses, &c.—The Chinese appear to have been acquainted with the properties of rhubarb from a period long anterior to the Christian era, for the drug is treated of in the herbal called *Pen-king*, which is attributed to the Emperor Shen-nung, the father of Chinese agriculture and medicine, who reigned about 2700 B.C. The drug is named there *Huang-háng*, yellow, excellent, and *Ta-huang*, the great yellow. The latter name also occurs in the great Geography of China, where it is stated that rhubarb was a tribute of the province Si-ning-fu, eastward of Lake Kuku Nor, from about the 7th to the 10th centuries of our era.

As regards Western Asia and Europe, we find a root called ῥᾶ or ῥηον, mentioned by Dioscorides as brought from beyond the Bosphorus. Pliny describes a root termed *Rhacoma*, which, when pounded, yielded a colour like that of wine, but inclining to saffron, and was brought from beyond Pontus. The drug thus described is usually regarded as rhubarb, or at least as the root of some species of Rheum. Lassen has shown that trading caravans from Shensi in Northern China arrived at Bokhara as early as the year 114 B.C. (*Pharmacographia.*)

Riwâs (the plant Ri in the Zend language) was known to the ancient Persians, and the same name is still applied to a species of Rheum in the province of Gilán in Persia. Aitchison found *R. Ribes*, Gronov., on the Paropamisus range, to be known to the peasantry as Rewash, Rewand and Chukri; he states that the flowering branches are eaten, and the root used in colouring leather. In the Hari-rud Valley he found *R. tataricum*, Linn., f., to be known as Rewash-i-dewána, "fools' rhubarb," the fruit and root being used as a purgative. Ibn Sina (978) notices both the plant Ribás (Riwás, *Pers.*) and the drug Ráwand (Rewand, *Pers.*)—the first an acid plant, and the second evidently Chinese rhubarb. Mesue, early in the 11th century, distinguishes between Chinese and Khorasan rhubarb, and Haji Zein-el-attár, writing in 1368, says:—"I consider Rewand to be the same as Ribás. Ibn Jazla, the author of the *Minháj*, states that there are two kinds, China and Khorasan rhubarb, and that the latter is known as Ráwand-el-dawább, and is used in veterinary practice, whilst the Chinese is reserved for human beings. The latter is the best kind, and, when powdered, is of a saffron colour; the fractured surface has the grain of a cow's hump, and is friable; it is called Rewand-i-lahmi (meaty rhubarb), and should be in large pieces like a horse's hoof, and not worm-eaten. In my experience there are three kinds of rhubarb—Chinese, Khorasan, and Indian. Masih (Mesue) states that rhubarb is hot in the third degree and dry in the first." (*Ikhtiárát*, article *Ráwand.*)

The author of the *Makhzan-el-Adwiya*, himself a native of Khorasan, has the following account of Ribás:—"It is called in Persian Riwás, Riwáj and Chukri, and is an herbaceous plant a cubit in height; from the centre spring one or two flattened stems, 2 fingers by 1 finger in thickness, having a pubescent bark, the lower portion of which is purplish and the upper green, like the stem of a lettuce. Internally the stem is white, soft and juicy; it has a sour and somewhat astringent taste. The top of the stem is branched, and between the branches are green rough bracts; the flowers are red, and have a slightly acid and sweetish taste. The plant grows in the cold snowy mountains; the best is the Persian, white, delicate, succulent and subacid, with a stout tall stalk. The root of this plant is rhubarb (Ráwand), which has already been described, and it is called 'Ribás-i-Mu'ammiri,' because one Mu'ammir of Nishapur was the first to discover this." For the history of rhuharb in Europe, the reader is referred to the *Pharmacographia.*

Rhubarb is not an article of the Hindu Materia Medica, but the modern Hindus have become acquainted with its properties through Mahometan and European physicians.

In the use of rhubarb as a medicine, the Mahometans quote and follow Galen, Oribasius, Paulus, Rází, Ibn Sina and Masih, whose opinions it is unnecessary to reproduce. In India it is chiefly used as a stomachic, tonic, and mild aperient.

The rhubarb found in the Indian bazars is of a very inferior kind, in long stick-like pieces, shipped to Calcutta and Bombay from the Eastern ports. It comes from China, and has hardly any aroma, a bitterish taste, and but slight purgative action. When fresh, it is covered with a yellow dust, like ordinary rhubarb. The natives use it as a tonic and stomachic. None of the commercial rhubarb known as East Indian is imported into Bombay unless specially ordered from China, but it often passes through the port on board the P. and O. Company's steamers. Bombay druggists, Native and European, usually obtain their rhubarb from London. On account of its low price, the former always import English rhubarb. In the *Pharmacopœia of India*, the bazar rhubarb of India is attributed to *Rheum emodi*, *R. Moorcroftianum*, and *R. Webbianum*, all Himalayan species; it is said to be of two kinds, large and small: "The first in cylindrical pieces, of various sizes and shapes, furrowed; cut obliquely at the extremities, about four inches long and an inch and a half in diameter; of a dark-brown colour, feeble rhubarb odour and bitter astringent taste; texture radiated, rather spongy, not presenting on fracture the marbled texture characteristic of ordinary rhubarb; pulverized with difficulty; powder of a dull brownish-yellow colour. The second consists of short transverse segments of the root branches; of a dark-brownish colour, odourless or nearly so, with a very bitter astringent taste." (*Op. cit.*, p. 187.) The first kind so exactly corresponds with the stick rhubarb imported from China, that we are of opinion that it was not Himalayan rhubarb, whilst the second probably was of Indian origin. Trials made with Himalayan rhubarb by Prof. Royle (*Calcutta Med. and Phys. Trans.*, iii., p. 439) and Mr. Twining (*Diseases of Bengal*, i., p. 220) are reported to have been satisfactory, and Dr. Hugh Cleghorn (*Madras Quart. Med. Journ.*, 1862, v., p. 464), who furnishes some interesting remarks on

Himalayan rhubarb, states that it is only an inferior variety that reaches the plains of Hindustan. He tested the action of the fresh root, and found it to resemble the action of Russian rhubarb. (*Op. cit.*, p. 188.)

Description.—China rhubarb consists of portions of a massive root which display considerable diversity of form, arising from the various operations of paring, slicing and trimming to which they have been subjected. Thus some pieces are cylindrical or rather barrel-shaped, others conical, while a large proportion are plano-convex, and others again are of no regular shape. These forms are not all found in the same package, the drug being usually sorted into *round* and *flat rhubarb.* The pieces are from 3 to 4 inches long by 2 to 3 inches in breadth. Many pieces are pierced with a hole. The drug is dusted over with a bright brownish-yellow powder, on removal of which the surface is seen to have a rusty-brown hue. The character which most readily distinguishes the rhubarb of China is that well-developed pieces, broken transversely, display dark lines arranged as an internal ring of star-like spots. In good rhubarb the interior is compact and veined with reddish-brown and white, sometimes mixed with iron-grey. The root when chewed tastes gritty, by reason of the crystals it contains of oxalate of calcium; but it is, besides, bitter, astringent and nauseous. The odour is peculiar. (*Pharmacographia.*) The characters of the *Chinese stick rhubarb* which is used in India have already been noticed; it would appear to consist of the smaller branches of the root which have been removed in preparing the drug for European commerce.

Chemical composition.—The purgative principle of rhubarb is *Cathartic acid,* a glucoside discovered by Kubly (*Bull. Soc. Chim. Paris,* 1866) in Senna in combination with calcium and magnesium, and now known to be present in many other purgative drugs. Rhubarb also contains *Chrysophanic acid,* $C^{15}H^{10}O^{4}$, and an allied substance *Emodin,* $C^{15}H^{10}O^{5}$; a tannin, $C^{26}H^{26}O^{14}$, named Rheo-tannic acid by Kubly; resins and mucilaginous matters. Small quantities of albuminoid substances, malic acid, fat and sugar have also been met with in rhubarb. The amount of the mineral constituents is exceedingly variable: Flückiger and Hanbury obtained from two good samples of China Rhubarb, dried at 100°C. and incinerated, 12·9 and 13·87 per cent. of ash; another pale sample yielded no less than 43·27 per cent. The ash consists of carbonates of calcium and potassium.

The following analyses by Elborne show the percentage composition of three samples of English Rhubarb and two of the Eastern drug:—

	R. officinale, ordinary cultivation.	R. officinale, high cultivation.	R. rhaponticum.	East Indian Rhubarb.	Russian Rhubarb.
Moisture	6·06	7·9	5·57	5·4	12·6
Ash	9·33	4·9	7·9	9·28	6·63
Mucilage (soluble in water)	6·5	4·8	4·1	4·0	5·5
Cathartic acid	3·5	3·2	3·3	4·5	3·2
Tannin and chrysophan	14·3	11·7	12·5	11·7	11·0
Organic acid	3·3	2·2	1·5	3·0	4·5
Resinous substances soluble in alcohol	2·6	2·0	3·4	4·6	5·2
Fat and free chrysophanic acid soluble in petroleum ether	0·4	0·3	0·2	0·7	1·5

Rumex vesicarius, *Linn., Campd. Rum.*, 129, *t.* 3, *f.* 1. 8; Chúka (*Hind., Beng., Bomb.*), Chúkra (*Sans.*), is cultivated all over Asia, and is used just as sorrel is in Europe; excellent 'potage à l'oseille' may be made with it The plant is, doubtless, one of the kinds of Hamáz (Dock) mentioned in Arabic works, and is much esteemed for its medicinal properties. The juice is said to allay the pain of toothache, and by its astringent properties to check nausea, promote the appetite, and allay morbid craving for unwholesome substances. The herb also is considered very cooling and of use in heat of stomach, and externally as an epithem to allay pain, especially that caused by the bites or stings of reptiles and insects. The seeds are said to have similar properties, and are prescribed roasted in dysentery, and as an antidote to scorpion stings. The root is also medicinal.

Description.—The fruit sold in the shops as Gulhamáz (Dock flowers) is reddish-brown, about $\frac{1}{10}$ of an inch long, and consists of three fringed, leaf-like expansions, each furnished with an oblong glandular body and attached at the base to a short thick pedicel; they enclose a triangular, polished, dark-brown seed.

Bijband.—Shining angular seeds (nuts), evidently derived from a species of Rumex. They are used as an aphrodisiac. Murray states that the fruit of *Polygonum aviculare*, Linn., is known as Bijband or Endraní in Sind. According to Atkinson, *Rumex Wallichii*, Meissn., referred by Hooker to *R. maritimus*, Linn., yields the Bijband of the bazars. Probably the seeds of several species are collected.

Rumex Patientia, which Hooker thinks, along with *R. aquaticus*, Linn., might be united with *R. orientalis*, Bernh., has been examined by W. Dahlen, who gives the following percentage composition:—Water, 92·18; Nitrogenous matter, 2·42; Oil, 0·48; Sugar, 0·37; Nitrogen-free extractive, 3·06; Fibre, 0·66; Ash, 0·82.

This plant is a native of the Western Himalaya and extends westward to Asia Minor, Syria and Greece; it was named by Hayne *R. Dioscoridis* (*Arnzeik.* xiii., 5, *t.* 5), from its having been identified with the λαπάθον of the ancients, and it is still called λαπαθο in Greece.

ARISTOLOCHIACEÆ.

ARISTOLOCHIA INDICA, *Linn.*

Fig.—*Wight Ic.*, *t.* 1858; *Griff. Ic. Pl. Asiat.*, *t.* 529; *Rheede, Hort. Mal. viii.*, *t.* 25. Indian Birthwort (*Eng.*).

Hab.—Throughout the low country of India. The stem and root.

Vernacular.—Isharmúl, Rudrajata (*Hind.*), Ishormúl (*Beng.*), Sápsand, Ishvari, Rudrajaṭa (*Mar.*), Sápsan, Ishwari (*Guz.*), Ichchura-mula, Peru-marindu (*Tam.*), Ishvara-veru, Govila (*Tel.*), Ishvari-beru, Nanjin-beru (*Can.*), Karalvekam, Ishvara-muri (*Mal.*), Sápús (*Goa*).

History, Uses, &c.—This scandent shrub is the Rudra-jata of the Rája Nirghanta; other Sanskrit names for it are Arkamúla, "lightning root"; Ishvari, "goddess"; Sunanda, "pleasing"; and Sudhy-upásya, "worthy of worship." It is considered to be attenuant, deobstruent, emmenagogue, antarthritic, and a valuable medicine in the bowel affections of children who are teething. In the Mahometan Materia Medica it is known as Zarawand-i-Hindí, and is admitted as an Indian substitute for Zarawand (*Aristolochia longa*). The early Portuguese settlers in India gave it the name of Raiz de Cobra, on account of its supposed efficacy against the bite of that snake.

The plant was first described by Rheede, who compares its odour to that of fresh ginger, and states that boiled in oil it is applied as a liniment to snake-bites, and a decoction given internally. It is also administered, rubbed to a paste with water or in decoction, in cold fevers, headache, flatulent distention, and dysuria. As a lotion it relieves gouty pains, and the powder with pepper and hot water stops bloody fluxes.

It appears to be the *Radix puloronica* of Rumphius, which is employed in Banda in decoction, in diseases of the intestines, and also in intermittent fevers. Ainslie (*Mat. Ind.*, ii., 298) notices its use by the Tamil doctors in the bowel complaints to which children are subject in consequence of indigestion and teething, and says they sometimes call the drug *Talashroolivayr.* He also says that the powder is taken internally in cases of snake-bites and applied to the bitten part. Loureiro (*Flor. Cochin-Chin.*, vol. ii., p. 528), speaking of the plant, says: "Prodest in colica, cibi inappetentia, febribus intermittentibus, obstructionibus, hydrope." Fleming (*Catalogue of Indian Plants*, p. 8) notices its use in Upper India as an emmenagogue and antarthritic.

The plant is placed in the secondary list of the *Pharmacopœia of India*, but no further information with regard to its medicinal properties is given. In Bombay Sápsan is chiefly prescribed in the bowel complaints of children and in cholera; it is regarded as a stimulant tonic, and is also applied externally to the abdomen. Babu T. N. Mukharji states that the juice of the fresh leaves is very useful in the croup of children, by inducing vomiting, without causing any depression. (*Amsterdam Cat.*, p. 21.)

Description.—The drug as sold in the shops consists of the root and stem, the latter in by far the larger proportion; in many parcels the stem only is to be found. It is either in short pieces, or the whole stem may be twisted into a kind of circular bundle. The thickest portion of the stem is ¼ to ½ an inch or more in diameter, and has a central woody column made up of about ten wedge-shaped portions. The bark is thick and corky, marked with longitudinal ridges and numerous small warty projections; it is of a yellowish-brown colour. The taste is bitter and camphoraceous, and the odour aromatic and agreeable.

Microscopic structure.—The wedge-shaped woody columns are traversed by large vessels, the medullary rays are distinct and easily traced into the bark; in the latter, which consists of starchy and corky parenchymatous tissue, there is a circular zone of large yellow stone-cells.

Chemical composition.—The air-dried roots were contused and digested for several days with warm 80 per cent. alcohol. The greater part of the alcohol from the resultant tincture was removed by distillation, but the last traces could be separated by spontaneous evaporation with difficulty, owing to soft resinous matter separating and floating on the surface and thus preventing evaporation. The extract still containing alcohol, and which possessed a strong smell of the drug, was mixed with water and agitated with light petroleum ether. During agitation a dark viscid resinous mass separated, as well as a small amount of a bright yellow powder. The clear aqueous solution, after separation of the petroleum ether, was gently heated to expel alcohol, and the residue acidified with sulphuric acid and agitated with ether. After separation of the ether, the aqueous solution was rendered alkaline and reagitated first with ether, then with chloroform, and lastly with amylic alcohol.

The dark resinous matter which separated on agitation with petroleum ether was repeatedly shaken with ether, in which a portion was soluble. The ethereal extract was of the consistence of honey, had a taste and smell like that of a mixture of turpentine and peppermint, and was also bitter: in alcohol it was soluble with acid reaction; it was dissolved by ammonia, forming a dark reddish orange-coloured solution, and was reprecipitated by acids in yellowish flocks. The residue insoluble in ether was soft when moist and dark chocolate in colour: on drying at 100°C. it became brittle, and could be easily reduced by pressure between the fingers to a yellowish powder which possessed neither taste nor odour: in alcohol it was soluble with acid reaction: in ammonia the greater part dissolved, and was reprecipitated in yellow flocks by acids. The bright yellow powder was soluble in ether, and was left on spontaneous evaporation as a bright yellow varnish, destitute of crystalline structure. In warm water the greater part dissolved, forming a pale yellow solution which became turbid on cooling and which had a marked acid reaction. In alkalies it was soluble with deep orange coloration, and was reprecipitated by acids in pale yellow flocks: with ferric chloride it gave a dirty brownish-red precipitate: with basic acetate of lead, yellowish flocks: with baryta water no precipitate, only a deep yellow coloration.

The light petroleum ether extract was soft and brownish in colour, and had a strong odour of turpentine; on gently heating in a small retort, a trace of a distillate was obtained which had a most powerful terebinthinate odour and taste.

The extract obtained by agitating the original aqueous acid solution with ether was a bright yellow, transparent, soft, varnish-like mass, from which slowly separated a few small yellowish nodules, which, on microscopic examination, were found to consist of bundles of rod-shaped crystals. The extract was soluble in alcohol with strong acid reaction, the solution exhibiting a well-marked greenish fluorescence, as did also an ethereal solution.

The taste was very bitter, aromatic, and also somewhat terebinthinate. On treatment with ammonia the extract was partly dissolved, yielding a deep orange-red solution, which was agitated with ether, the ether showing a marked greenish fluorescence. On evaporating off the ether, a bright yellow, viscid, transparent extract was left, with a bitterish taste, accompanied by a strong one of turpentine. In alcoholic solution the extract was neutral in reaction, the solution exhibiting a marked fluorescence. The ammoniacal solution, after separation of the ether, was acidulated with sulphuric acid and reagitated with ether. On evaporation of the ether, a bright yellow, soft, varnish-like residue was left; on heating with water the greater part dissolved, forming a clear solution which became turbid on cooling. With alkalies the extract gave a deep orange-red solution: with ferric chloride a dirty brownish-red precipitate: with basic lead acetate yellowish flocks were precipitated: with lime and baryta water a yellowish coloration, but no precipitates. After boiling with dilute sulphuric acid, Fehling's solution was reduced. The reactions of this acid were, therefore, similar to those of the *yellow powder* which separated on agitation with petroleum ether.

The original solution after addition of sulphuric acid was rendered alkaline with ammonia and agitated with ether. On spontaneous evaporation of the ether, a yellow, soft, non-crystalline, transparent, varnish-like extract was left. This was treated with a little dilute sulphuric acid, in which a portion only dissolved, and agitated with ether, which removed resinous matter. The ether was then separated, and the aqueous solution rendered alkaline, and reagitated with ether. A yellow non-crystalline extract was obtained, which was nearly wholly soluble in dilute sulphuric acid, and which afforded the following reactions: with ammonia a white precipitate soluble in excess: with caustic soda a similar precipitate, only slightly soluble in excess: with platinic and auric chlorides yellow precipitates: marked yellow precipitate with Mayer's reagent, and with other alkaloidal reagents: with strong nitric acid a yellowish coloration: with Fröhde's reagent a deep-blue coloration in the cold, no alteration in tint on gently heating. After boiling with dilute sulphuric acid, the liquid slightly reduced Fehling's solution.

After agitation with ether, the liquid was agitated with chloroform, which separated an alkaloidal principle mixed with much colouring matter. The reactions were similar to those yielded by the principle extracted by ether.

Finally the liquid was agitated with amylic alcohol, the alcohol exhibiting very marked greenish fluorescence. The amylic alcohol extract contained a large amount of resinous matter insoluble in dilute sulphuric acid ; the acid solution afforded, however, very marked evidence of the presence of a principle reacting with alkaloidal reagents, the colour reactions being similar to those yielded by the principle separated by ether and chloroform. It would be premature for us to definitely state that the principles extracted by ether, chloroform, and amylic alcohol were either identical or different.

Toxicology.—Dr. S. M. Shircore of Moorshedabad states that it is undoubtedly used to procure abortion.

Commerce.—The drug can hardly be called an article of commerce, as it is supplied to the shops by herbalists or country people. It is very abundant in the Southern Concan. Value, annas 6 per pound.

ARISTOLOCHIA BRACTEATA, *Retz.*

Hab.—Deccan Peninsula to Bandelkand, Sind, Ceylon. The herb.

Vernacular.—Kiramár, Gandháni (*Hind.*), Kiramár (*Guz.*), Gandhán-gavat, Gándháni (*Mar.*), Ganajali-hullu, Kattagiri (*Can.*), Adutina-pálai (*Tam.*), Gádide-gadapara-áku, Kadapara (*Tel.*), Átutinta-pála (*Mal.*).

History, Uses, &c.—This plant is the Dhúmra-pattra of the Rája Nirghanta, *i.e.*, the plant with grey leaves. The synonyms are :—Dhúmráhva, Su-labhá, Svayam-bhuva, Gridhra pattra, Gridhráni, Krimi-ghni, Srima-lápaha. It is much used by Hindu physicians on account of its bitter, purgative, and anthelmintic properties. The leaves are applied to the navel to move the bowels of children, and are also given internally in combination with castor oil as a remedy for colic. The juice of the fresh leaves or the powder of the dried leaves is a favourite application to sores to destroy maggots. In the Kurnool District, when the *sazza* is attacked with insects, a long rope soaked in the juice of the plant, and with the leaves of the plant attached, is drawn over the crop. Dr. Hové, who visited Bombay in 1787, found the plant growing in great abundance in Guzerat. He states that the root and leaf are remarkably bitter, and yield a thick yellowish juice, which is mixed with boiled milk and given in syphilis, and combined with opium is used with great success in gonorrhœa. Ainslie notices the application of the leaf, when bruised and mixed with castor oil, to obstinate psora (the Carpang of the Tamils). The plant is also thought to stimulate uterine contraction, and is administered in tedious labour and as an emmenagogue. In Dalzell and Gibson's *Flora of Bombay* (p. 225) it is spoken of as possessing a merited reputation as an antiperiodic in intermittent fevers. The native doctors in Bombay make a paste with water, of the plant, along with the seeds of *Barringtonia acutangula, Celastrus paniculata*, and black pepper, and rub the whole body with it for the cure of malarial fevers.

The evidence collected by Dr. Watt (*Dict. Econ. Prod. India*, i., 314) shows that it is the opinion of several European physicians in different parts of India that the plant has a decided action upon the uterus, and increases or induces uterine contractions. There appears to be no doubt as to its anthelmintic properties.

Description.—The drug consists of the whole plant in fruit; the stems are striated, slender, and about as thick as a piece of whipcord; the leaves are of a pale, glaucous green, obtuse, heart-shaped, with wavy edges, about 2 inches long and 1½ inch broad, when dry they are blackish; the capsules are ovate, ¾ of an inch long, ribbed, depressed at the apex, six-celled;

each cell contains a column of heart-shaped flat seeds, closely packed. The appearance of the seeds is peculiar, they look as if they had been cut out with a punch ; one side is flat, black, and rough from a number of irregular projections; the other is almost entirely occupied by two brown comparatively smooth lobular projections of a soft corky structure; these under the microscope are seen to be entirely composed of ovate, empty, dotted cells. The whole plant is nauseously bitter.

Chemical composition.—The plant contains a nauseous volatile substance, an alkaloid, and a large quantity of salts. The alkaloid is amorphous and gives no colour reactions with the strong mineral acids. The bitter concentrated tincture on standing deposited cubical crystals of potassium chloride. The ash calculated on the air-dried plant was 17·75 per cent., and strong alkaline fumes were given off from the plant when burning.

Commerce.—Value, Rs. 3½ per maund of 37½ lbs.

Zarawand-i-gird (*Pers., Ind. Bazars*). The imported root of *Aristolochia rotunda*, Linn., *Guib. Hist. Nat.*, ii., p. 371, a small plant with slender stems and almost sessile, obtusely cordiform leaves. The flowers are solitary in the axils of the leaves, tubular, yellow without, and orange brown within. The whole plant is acrid, aromatic and bitter. The root is tuberous, placentiform, hard and heavy when dry, more or less mammillated on the under surface, of a reddish-brown colour; on the upper surface are the remains of several stems or small pits showing where they were attached; on the under surface one central scar marking the attachment of the rootlets. The substance is very hard and horny, and has a bitterish somewhat aromatic taste, and camphoraceous odour.

Zarawand-i-tawil (*Pers., Ind. Bazars*). The imported root of *Aristolochia longa*, Linn., *Mill. Ic.*, *t.* 51, *f.* 2, a plant much resembling *A. rotunda*, and having a similar habitat. It differs from the latter plant in having petioled leaves, yellow flowers striped with brown, and a cylindrical root which has much the same taste and odour as that of *A. rotunda*. Mahometan physicians describe it as resolvent, deobstruent, diuretic, emmenagogue, alexipharmic, and vermifuge.*

These Aristolochias were formerly considered to be antidotes for snake-bites. Albertus Magnus (*De mirabilibus Mundi*) says:—"Si vis statim interficere serpentem, accipe ex Aristolochia rotunda quantum vis et tere illam bene, et accipe ranam sylvestrem vel campestrem et contere ipsam et commisce eam Aristolochia, et pone cum eo aliquid ex incausto, et scribe cum eo in charta aut aliquo quod plus amas, et projice ad serpentes."

Zaráwand-i-gird, or mudahraj, is considered by Persian writers on Materia Medica to be the female of *Aristolochia longa.* Mír Muhammad Husain tells us that at Ispahan it is called Nukhud-i-alwandi. Mahometan physicians describe it as resolvent, stimulating, pectoral, stomachic, and cephalic; they prescribe it in jaundice and gout. True Zaráwand-i-gird is very scarce in India; most of the druggists, when asked for it, supply the small starchy, inert tuber of an arum.†

The Aristolochias are still collected by herbalists in Southern Europe for medicinal use.

PIPERACEÆ.

PIPER NIGRUM, *Linn.*

Fig.—*Miq. Ill. Pip.* 50, *t.* 50; *Bot. Mag., t.* 3139; *Bentl. and. Trim., t.* 245; Black Pepper (*Eng.*), Poivre noir (*Fr.*).

Hab.—Travancore and Malabar. Cultivated elsewhere. The fruit.

Vernacular.—Mirach, Káli-mirach (*Hind.*), Gol-marich (*Beng.*), Milagu (*Tam.*), Miriyálu (*Tel.*), Kuru-mulaka (*Mal.*), Menasu (*Can.*), Miri, Káli-miri (*Mar.*), Kalo-miri (*Guz.*). White pepper bears the same names with the addition or substitution of the adjective "white."

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* Compare with the description of the two Aristolochias in Dioscorides (iii., 4) *περὶ αριστολοχίας στρογγύλης.* Pliny mentions their use by women to procure male offspring, and Apuleius recommends them as a protective against the evil eye.

† *Pinellia tuberifera*, Tenore, the *Sang-pwan-hea* of the Chinese, growing about Pekin (*Hance, Linn. Journ. Bot.*, xiii. (1872), 88), figured and described by Hanbury. (*Science Papers*, p. 262.)

History, Uses, &c.—The earliest travellers from the West who visited India, found the pepper vine in cultivation on the Malabar Coast. Theophrastus (H. P. ix., 22) mentions two kinds of pepper (*πίπερι* or *πέπεμι*) in the fourth century B. C., and Dioscorides (ii., 148) mentions *λευκον πέπερι*, white pepper, *μακρόν πέπερι*, long pepper, and *μέλαν πέπερι*, black pepper. Pliny says:—"It is quite surprising that the use of pepper has come so much into fashion, seeing that in other substances which we use, it is sometimes their sweetness, and sometimes their appearance, that has attracted our notice; whereas, pepper has nothing in it that can plead as a recommendation to either fruit or berry, its only desirable quality being a certain pungency; and yet it is for this that we import it all the way from India! Who was the first to make trial of it as an article of food? and who, I wonder, was the man that was not content to prepare himself, by hunger only, for the satisfying of a greedy appetite?" (12, 14.)

In the Periplus of the Erythrean Sea, written about A.D. 64, it is stated that pepper is exported from Baraké, the shipping place of Nelkunda. in which region, and there only, it grows in great quantity. These have been identified with places on the Malabar Coast between Mangalore and Calicut.

Long pepper and Black pepper are among the Indian spices on which the Romans levied duty at Alexandria about A.D. 176.

Cosmas Indicopleustes, a merchant, and in later life a monk, who wrote about A.D. 540, appears to have visited the Malabar Coast, or at all events had some information about the pepper-plant from an eye-witness. It is he who furnishes the first particulars about it, stating that it is a climbing plant, sticking close to high trees like a vine. Its native country he calls *Male.* The Arabian authors of the Middle Ages, as Ibn Khurdádbah (*circa* A.D. 869-885), Edrisi in the middle of the 12th, and Ibn Batuta in the 14th century, furnished nearly similar accounts.

Among Europeans who described the pepper-plant with some exactness, one of the first was Benjamin of Tudela, who visited the Malabar Coast in A.D. 1166. Another was the Catalan friar, Jordanus, about 1330; he described the plant as something like ivy, climbing trees and forming fruit, like that of the wild vine. "This fruit," he says, "is at first green, then, when it comes to maturity, black." Nearly the same statements are repeated by Nicolo Conti, a Venetian, who, at the beginning of the 15th century, spent twenty-five years in the East. He observed the plant in Sumatra, and also described it as resembling ivy. (*Pharmacographia.*)

The high cost of pepper contributed to incite the Portuguese to seek for a sea passage to India, and the trade in this spice continued to be a monopoly of the Crown of Portugal as late as the 18th century.

In January 1793, an agreement was made between the Rajah of Travancore and the English, by which he was to supply a large quantity of pepper to the Bombay Government in return for arms, ammunition and European goods; this was known as the "Pepper Contract."

It is worthy of remark that all the foreign names for black pepper are derived from Pippali, the Sanskrit name for long pepper, which leads one to suppose that the latter spice was the first kind of pepper known to the ancient Persians and Arabs, through whose hands it first reached Europe. Their earlier writers describe the plant as a shrub like the Pomegranate (*P. chaba ?*). The moderns apply the name Filfil (Pilpil, *Pers.*) to all kinds of pepper. Black pepper is called in Sanskrit Maricha, which means a "pungent berry." The word is derived from Marichi, "a particle of light or fire," and appears to have been first applied to the aromatic berries known as Kakkola; it now signifies black and red pepper, and in the vernacular forms of Mirach or Mirchai, is a household word in India.

Maricha is described in the Nighantas as bitter, pungent, digestive, hot and dry; synonyms for it are Valli-ja "creeper grown," Ushana, Tikshna "pungent," Malina, Syama "black," &c. It is said to be useful in intermittent fever, hæmorrhoids, dyspepsia, cough, gonorrhœa and flatulence, and to promote the secretion of bile. Together with long pepper and ginger it forms the much-used compound known as Trikatu, "the three acrids," or "Ushana-chatu-rushana." Externally, pepper is used as a rubefacient and stimulant of the skin. In obstinate intermittent fever and flatulent dyspepsia, the Hindus administer white or black pepper in the following manner:—A tablespoonful is boiled overnight in one seer of water, until the water is reduced to one-fourth of its bulk, the decoction is allowed to cool during the night, and is taken in the morning. The pepper is then again boiled in the same manner and the decoction taken at night. This treatment is continued for seven successive days. A compound confection of pepper (*Pránada gudiká*) is given as a remedy for piles; it is made in the following manner:—Take of black pepper 32 tolas, ginger 24 tolas, long pepper 16 tolas, *Piper chaba* (chavya) 8 tolas, leaves of *Taxus baccata* (tálisa) 8 tolas, flowers of *Mesua ferrea* (nágkesar) 4 tolas, long pepper root 16 tolas, cinnamon leaves and cinnamon one tola each, cardamoms and the root of *Andropogon muricatus* (usira) 2 tolas each, old treacle 240 tolas; rub them together. Dose about 2 drachms. When there is costiveness, chebulic myrobalans are substituted for ginger in the above prescription. (*Chakradatta.*)

The use of pepper for the cure of intermittents is strongly recommended by Stephanus in his commentary on Galen, and recently some cases of refractory intermittent fever, in which, after the failure of quinine, piperine has been administered with advantage, are reported by Dr. C. S. Taylor (*Brit. Med. Journ.*, Sept., 1886). In one case, immediately on the accession of an attack, three grains of piperine were given every hour, until eighteen grains had been taken, and on the following day, when the intermission was complete, the same dose was given every three hours.

Mahometan physicians describe black pepper as deobstruent, resolvent, and alexipharmic; as a nervine tonic it is given internally, and applied externally in paralytic affections; in toothache it is used as a mouth-wash. As a tonic and digestive, it is given in dyspepsia. With vinegar it forms a good stimulating poultice. With honey it is useful in coughs and colds. Moreover, it is diuretic and emmenagogue, and a good stimulant in cases of bites by venomous reptiles. Strong friction with pepper, onions, and salt is said to make the hair grow again upon the bald patches left by ringworm of the scalp. They notice the use of the unripe fruit, preserved in salt and water as a pickle, by the natives of Malabar.

De Gubernatis draws attention to the following passage from the travels of Vincenzo Maria da Santa Caterina (iv., 3) with reference to white pepper being offered by the Hindus to their gods in Malabar:—"Da Malavari è tenuto in stima grandissima, eli Gentili d'ordinario l'offrono a 'loro Dei, si per la rarità come per la virtù salutifera e medicinale, che da quello sperimentano, riportandolo poi alli infermi." For the early history of pepper in Europe, the *Pharmacographia* may be consulted.

Cultivation.—Its cultivation is very simple, and is effected by cuttings or suckers put down before the commencement of the rains in June. The soil should be rich, but if too much moisture be allowed to accumulate near the roots, the young plants are apt to rot. In three years the vine begins to bear. They are planted chiefly in hilly districts, but thrive well enough in the low country in the moist climate of Malabar. They are usually planted at the base of trees which have rough or prickly bark, such as the jack, the erythrina, cashewnut, mango-tree, and others of similar description. They will climb about 20 or 30 feet, but are purposely kept lower than that. During their growth it is requisite to remove all suckers, and the vine should be pruned, thinned, and kept clean of weeds. After the berries have been gathered, they are dried on mats in the sun, turning from red to black. They must be plucked before they are quite ripe, and if too early they will spoil. White pepper is the same fruit freed from its outer skin, the ripe berries being macerated in water for the purpose. In this latter state they are smaller, of greyish-white colour, and have a less aromatic or pungent taste. The pepper-vine is very common in the hilly districts of Travancore, especially in the Cottayam, Meenachel, and Chenganacherry districts, where, at an average calculation, about 5,000 candies are produced annually. It is a Government monopoly. (*Drury.*)

Description.—The immature fruit, known as Black Pepper, is globular, about ⅕ of an inch in diameter, much wrinkled, and of a brown-black colour; on one side are the remains of the peduncle, and on the other of the style and stigmas. The pericarp is closely adherent to the seed. The latter consists of a thin reddish-brown testa and a copious albumen, the exterior portion of which is horny and the interior farinaceous. The embryo is undeveloped. The mature seed, known as White Pepper, is less acrid than Black, as the pericarp has been removed; it is also rather smaller and of a grey colour, striated from base to apex by about a dozen light stripes.

The transverse section of a grain of black pepper exhibits a soft, yellowish epidermis covering the outer pericarp. This is formed of a closely-packed yellow layer of large, mostly radially arranged, thick-walled cells, each containing in its small cavity a mass of dark-brown resin. The middle layer of the pericarp consists of soft, tangentially-extended parenchyme, containing an abundance of extremely small starch granules and drops of oil. The shrinking of this loose middle layer is the chief cause of the deep wrinkles on the surface of the berry. The next inner layer of the pericarp exhibits towards its circumference, tangentially-arranged soft parenchyme, the cells of which possess either spiral striation or spiral fibres, but towards the interior, loose parenchyme free from starch and containing very large oil cells.

The testa is formed in the first place of a row of small yellow thick-walled cells. Next to them follows the true testa, as a dense, dark-brown layer of lignified cells, the individual outlines of which are undistinguishable.

The albumen of the seed consists of angular, radially arranged, large-celled parenchyme. Most of its cells are colourless and loaded with starch; others contain a soft, yellow, amorphous mass. If thin slices are kept under glycerine for some time, these masses are slowly transformed into needle-shaped crystals of piperin. (*Pharmacographia.*)

Chemical composition.—Black pepper contains an acrid resin, a volatile oil, starch, gum, a small quantity of fatty oil in the mesocarp, and about 5 per cent. of inorganic matter, besides the alkaloid *piperine,* and a volatile alkaloid which is probably identical with *piperidine.* The acrid resin is dark-green, soluble in alcohol, ether and alkalies, and, in connection with other constituents of pepper, also in water. C. Heisch (*Analyst,* xi., 186-190) has shown that pepper should contain not less than 50 per cent. of starch, which is characterised by the smallness of its granules. The essential oil has been examined by L. A. Eberhardt (*Archiv. d. Pharm.* (3), XXV., 515-519); it had a sp. gr. of 0·87352 at 15° C., and showed a greenish colour, due neither to chlorophyll nor to copper. At 22° the oil had a lævorotatory power of 3·2° in a column 100 mm. long. On rectification a very small quantity passed over at 160°. Fractions obtained at 170°, 176° and 180° were colourless; that obtained at 190° faint green, and that at 250° green, that passing over at 310° brown-green. Above 310° a brown, tenacious residue was obtained in which phenol could not be detected. The 170° fraction, when rectified under reduced pressure, gave a terpene boiling at 164°—165°, and showed a left-handed rotation of 7·6° in 100 mm.; it gave numbers agreeing with the formula $C^{10}H^{16}$.

The composition of the other fractions was much the same as this. The oil consists of a lævorotatory terpene and isomeric compounds of higher boiling point. (*Journ. Chem. Soc.,* Oct., 1887; *Year-Book Pharm.,* 1888.)

Pure piperine crystallizes in colourless flat, four-sided prisms of a glassy lustre and almost tasteless. As usually met with, it is of a yellowish colour, inodorous, and has at first a slight, but on continued mastication, or in alcoholic solution, a sharp, peppery taste. It remains unaltered on exposure, has a neutral reaction to test-paper, is nearly insoluble in water, and dissolves in volatile oils, in 60 parts of cold ether (*Merck*), in 30 parts of cold and in 1 part of boiling 80 per cent. alcohol (*Wittstein*), and freely in acetic acid; the last two solutions are precipitated on the addition of water. It is likewise soluble in chloroform, benzol, and benzin. At 129° C. it melts like wax to a yellowish oily liquid, which on cooling congeals to a mass of resinous appearance; when fused it may be ignited, and burns with a bright flame, leaving a light charcoal, which is readily consumed by heating it in the air. Sulphuric acid colours it blood-red, the colour disappearing on the addition of water, leaving the piperine unaltered if the action of the acid has not been prolonged (*Pelletier*). The solution of piperine in sulphuric acid is yellow, becoming dark-brown, and finally green-brown (*Dragendorff*). Nitric acid colours piperine successively greenish-yellow, orange, and red, and dissolves it with a yellow colour, the solution separating yellow floccules on the addition of water; by prolonging the action of the acid, oxalic acid and a yellow bitter compound are produced (*Pelletier*). The resin resulting from this reaction becomes blood-red on the addition of potassa, and on heating the mixture piperidine is given off (*Anderson*, 1850). Piperine is a very weak base, and its salts are decomposed by water; crystallizable double salts, soluble in alcohol, may be obtained with the chlorides of mercury, platinum, and cadmium. By dry distillation with soda-lime piperidine is obtained. Boiled with alcoholic solution of potassa, piperine was found by Babo and Keller (1856) to be resolved into *piperic acid*, $C^{12}H^{10}O^4$, and *piperidine*, $C^5H^{11}N$. Piperic acid is in hair-like, yellowish, needles which fuse at 150° C., and at a higher temperature volatilize partly unaltered, at the same time giving off a coumarin-like odour. Piperidine is a colourless liquid of an ammoniacal and pepper-like odour, and when largely diluted of a bitter taste. It boils at 106° C., has a strong alkaline reaction, dissolves freely in water and alcohol, and yields with acids crystallizable salts; the piperate of piperidine crystallizes in silky scales, which, on being heated, give off a part of the alkaloid. Ladenburg (1884) obtained a small quantity of piperidine synthetically by treating an alcoholic solution of pyridine with sodium. (*National Dispensatory.*) Heisch

(*Analyst,* 1886) gives the following analysis of pure and commercial peppers:—

	Water.	Total ash.	Ash soluble in water.	Ash soluble in acid.	Insoluble ash.	Alkalinity as K^{2}o.	Starch.	Alcoholic extract.	Piperin.
Black berry ...	9·22 to 14·36	4·35 to 8·93	1·54 to 3·34	1·51 to 3·83	·36 to 4·38	·72 to 1·57	48·53 to 56·67	10·47 to 16·2	4·05 to 9·38
White berry ...	13·67 to 17·32	1·28 to 8·78	·217 to ·618	·84 to 2·80	·22 to ·69	... ·22	76·27 to 77·68	9·23 to 9·73	5·13 to 6·14
Fine ground white	13·90	1·58	·16	·9	·52	...	75·31	10·66	4·51
Long pepper	12·15	13·48	2·28	5·52	5·68	·53	58·78	8·29	1·71
Adulterated ground	11·12	14·7	2·02	4·07	8·61	·78	35·85	11·57	2·03

W. Johnstone (*Chem. News,* Nov., 1889) has shown that pepper contains a volatile alkaloid probably identical with piperidine. Black pepper yielded 0·56 per cent., and the husks alone 0·74 per cent., of this base. White pepper yielded it also, but in smaller quantity, and the larger proportion of piperidine in the husk, the author considers to be an explanation of the greater pungency of black pepper as compared with white pepper. Long pepper was found to yield 0·34 per cent. of the alkaloid. (*Year-Book Pharm.,* 1889.)

Commerce.—The exports of pepper from the Malabar Coast for the past 6 years have been—

	Cwts.
1884-85	91,516
1885-86	100,804
1886-87	106,976
1887-88	136,605
1888-89	101,177
1889-90	141,257

The Travancore State exports annually about 3,000 candies of pepper, each candy containing 500 English lbs., and this brings to the State an annual income of 6 lakhs of rupees.

Adulteration.—As pepper is always sold whole in India, it is seldom adulterated. We have occasionally met with an admixture of the berries of *Embelia Ribes,* and the fruit of *Mirabilis Jalapa* is stated to be sometimes mixed with it.

The abortive berries of **P. troicium,** *Roxb.,* now considered to be the wild form of *P. nigrum,* are known in Western India as Pokali-miri, and the plant as Kokervel in Marathi and Murialtiga in Telugu. Garcia d' Orta notices the drug under the name of Canarese pepper, and observes that it never finds its way to Portugal, but is valued as a medicine by the natives to purge the brain of phlegm, to relieve toothache, and as a remedy for cholera.

This plant was first described by Roxburgh, who found it growing wild in the hills north of Samulcotta.

It was growing plentifully about every valley among the hills, delighting in a moist rich soil, and well shaded by trees; the flowers appearing in September and October, and the berries ripening in March. Roxburgh commenced a large plantation, and in 1789 it contained about 40,000 or 50,000 pepper-vines, occupying about 50 acres of land. The produce was great, about 1,000 vines yielding from 500 to 1,000 lbs. of berries. He discovered that the pepper of the female vines did not ripen properly, but dropped while green, and that when dried it had not the pungency of the common pepper; whereas the pepper of those plants which had the hermaphrodite and female flowers mixed on the same ament was exceedingly pungent, and was reckoned by the merchants equal to the best Malabar pepper.

Pliny (12,14) mentions abortive pepper seeds known by the name of "Bregma," a word which in the Indian language signifies "dead." He remarks that it is the most pungent kind of pepper.

Lendi-pipali. Globular catkins of a species of pepper occasionally found in the Bombay market, said to come from Singapore. They are of the size of the pellets of sheep's dung, hence the name Lendí-pípalí. The taste is very hot and acrid.

The individual fruits are nearly as large as cardamom seeds, the whole catkin having much the appearance of a small blackberry.

PIPER CHABA, *Hunter.*

Fig.—*Miq. Ill. Pip.*, *t.* 34; *Hayne, Arnz., Gewachs. xiv.*, *t.* 21; *Wight Ic.*, *t.* 1927. Long Pepper (*Eng.*), Poivre long (*Fr.*).

Hab.—Cultivated in India and the Malay Islands. The fruit and stem.

Vernacular.—Cháb (*Hind.*), Chai (*Beng.*), Chavak (*Mar.*).

PIPER LONGUM, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 244; *Miq. Ill. Pip.*, *t.* 30; *Hayne, Arnz. Gewachs. xiv.*, *t.* 20; *Wight Ic.*, *t.* 1928; *Rheede, Hort. Mal. vii.*, *t.* 14.

Hab.—Hotter provinces of India. The fruit and root.

Vernacular.—The fruit.—Pipal, Pippali (*Hind.*), Tippili (*Tam.*), Pippallu (*Tel.*), Tippali (*Mal.*), Yippali (*Can.*), Pipul (*Beng.*), Bangáli-pipali (*Mar.*), Pipara (*Guz.*). The root.—Pippali-múl, Pipla-múl, Pipla-mur (*Hind.*), Tippili-mulam, Tippili-vér (*Tam.*), Modi, Pippali-katta (*Tel.*), Tippili-vér (*Mal.*), Pipuli-múl (*Beng.*), Pipali-múl (*Mar.*, *Guz.*).

History, Uses, &c.—As we have already stated, we think it highly probable that long pepper was the kind of pepper first known to the ancient inhabitants of Western Asia and Europe. (See *P. nigrum.*) In Sanskrit works on medicine, *P. longum* is described under the name of Pippali, and bears the synonyms of Chapalá, Pála, Mágadhi "growing in South Bihar," Kaná, Shaundi, &c. It is considered to be digestive, sweet, cold, bitter, emollient and light; useful in rheumatism, asthma, cough, abdominal enlargements, fever, leprosy, gonorrhœa, piles and spleen. Old long pepper is to be preferred to fresh. A mixture of long pepper, long pepper root, black pepper and ginger in equal parts, is prescribed by several writers as a useful combination for catarrh and hoarseness. As an alterative tonic, long pepper is recommended for use in a peculiar manner. An infusion of three long peppers is to be taken with honey on the first day, then for ten successive days the dose is to be increased by three peppers every day, so that on the tenth day the patient will take thirty at one dose. Then the dose is to be gradually reduced by three daily, and finally the medicine is to be omitted. Thus administered, it is said to act as a valuable alterative tonic in paraplegia, chronic cough, enlargements of the spleen and other abdominal viscera. Long pepper and black pepper enter into the composition of several irritating snuffs; boiled with ginger, mustard oil, buttermilk and curds it forms a liniment used in sciatica and paralysis. In the Concan the roasted aments are beaten up with honey and given in rheumatism; they are also given powdered with black pepper and rock salt (two parts of long pepper, three of black, and one of salt) in half tolá doses for colic. Mahometan writers, under the name of Dárfilfil, describe long pepper as a resolvent of cold humours; they say it removes obstructions of the liver and spleen, and promotes digestion by its tonic properties; moreover, it is aphrodisiacal, diuretic, and emmenagogue. Both it and the root (Filfil-muiyeh) are much prescribed in palsy, gout, lumbago, and other diseases of a similar nature. A collyrium of long pepper is recommended for night blindness; made into a liniment it is applied to the bites of venomous reptiles. We learn from Roxburgh (*Flora Indica,* I., p. 155) "that it is in Bengal only that *Piper longum* is cultivated for its pepper. When the ament is full-grown, it is gathered and daily exposed to the sun till perfectly dry; after which it is packed in bags for sale. The roots and thickest part of the creeping stems, when cut into small pieces and dried, form a considerable article of commerce all over India, under the name of Pippali-mula, for which purpose it is particularly cultivated in many of the valleys amongst the Sircar mountains. This sort is more esteemed, and bears a higher price than that of Bengal, where by far the largest portion is cultivated. It, as well as the pepper, is chiefly employed medicinally, and the consumption of both these drugs is very great." *Piper longum* was formerly cultivated at Poway, near Bombay; it appears to grow well in gardens in Bombay, but requires plenty of manure.

Pippali-mula, with the synonyms Kana-mula, Katu-granthi, Ushana-granthika, Chataka and Chataka-shira, is described in the Nighantas as having the same properties as long pepper. *P. Chaba,* which produces the long pepper of European commerce, is the Chavi, Chavika and Chavya of Sanskrit writers. It is considered to have the same properties as *P. longum.* The aments are sold in the bazars as Mothi pippali, and the stem as Cháb, Chai or Chavak.

The oblong black pepper of Theophrastus (H. P., ix., 22) was probably long pepper. Dioscorides, in his article upon the three peppers, mentions a pepper root, and says it resembles Costus, has a hot taste, and causes salivation when chewed. This drug was probably Galangal, which is known as Pán-ki-jar or root of *Piper Betle,* because its odour somewhat resembles that of Betle leaves.

Description.—The ament of *P. Chaba,* the long pepper of European commerce, consists of a multitude of minute baccate fruits, closely packed round a common axis, the whole forming a spike 1½ inch long and ¼ inch thick. The spike is supported on a stalk ½ an inch long; it is rounded above and below, and tapers slightly towards its upper end. The fruits are ovoid, $\frac{1}{10}$ of an inch long, crowned with a nipple-like point (stigma), and arranged spirally with a small peltate bract beneath each. Beneath the pericarp, the thin brown testa encloses a colourless albumen, of which the obtuser end is occupied by the small embryo. The colour of commercial long pepper is greyish-white, as if it had been rolled in some earthy powder. When washed the spikes are reddish-brown. The drug has a burning aromatic taste, and an agreeable odour.

The ament of *P. longum* has a similar structure, but is shorter, more slender and less pungent. When fresh it has hardly any aroma, but in the process of drying it gradually developes an aromatic taste and odour.

Pippali-mula, or pepper root, when fresh, is a fleshy, crooked, and knotted root about the size of a goose-quill, with many smaller rootlets branching from it. The cortical portion is very thick, and covered by a thin smooth brown epidermis. The central woody column is soft and divided into from 4 to 6 wedge-shaped portions by from 4 to 6 very conspicuous medullary rays.

Microscopic structure.—The epidermis of the root consists of several rows of tangentially extended brown cells. The parenchyme of the cortex is chiefly composed of large thin-walled cells loaded with starch, and containing drops of essential oil. Amongst them are scattered cells containing a refractive yellow substance (resin). The central woody column is also loaded with starch, and contains as many resin-cells as the cortex. The medullary rays are abundantly provided with large scalariform vessels.

Chemical composition.—The constituents of long pepper are the same as those of black pepper.

A third kind of long pepper is met with in the bazars, which is known as Swaheli or Sugandhi-pippali, and is imported from Zanzibar. It has a peculiarly fragrant odour, and is administered with honey as a remedy for cough; it has not the acridity of the other long peppers.

The aments are from 1 to 2½ inches in length, flexuose, many of them barren or nearly so, only one or two fruits having come to maturity. These aments are almost filiform. The peduncle is about one inch long. The mature fruit after being soaked in water is $\frac{1}{12}$ inch in diameter, pyriform, mucronate (the *mucro* bifurcated), sessile; it consists of a pulpy envelope enclosing a somewhat pyriform seed resembling in structure that of other peppers.

Commerce.—Three kinds of long pepper are met with in the Indian market—1*st*, Singapore, which is identical with the long pepper of European commerce; 2*nd*, Bangáli, the produce of *P. longum*, cultivated in Bengal; 3*rd*, Swaheli, imported from Zanzibar.

Value, Singapore, Rs. 7 to Rs. 12 per maund of 41 lbs.; Bengal, Rs. 9; Zanzibar, Rs. 5. Pippali-mul is also of three kinds: Mirzapore, Rs. 10 to Rs. 40; Bengal, Rs. 7 to Rs. 7½; Malwa, Rs. 50 per maund of 41 lbs.

PIPER CUBEBA, *Linn. f.*

Fig.—*Bentl. and Trim.*, *t.* 243. Cubebs (*Eng.*), Cubèbes (*Fr.*)

Hab.—Java. The fruit.

Vernacular.—Kabáb-chini, Kankol (*Hind.*), Kankola (*Mar.*), Vál-milaku (*Tam.*), Toka-miriyalu, Chalava-miriyalu (*Tel.*), Vál-mulaka (*Mal.*), Bála-menasu (*Can.*), Chini-kabáb (*Guz.*).

History, Uses, &c.—Cubebs were introduced into medicine by the Arabian physicians of the Middle Ages. Masudi in the 10th century stated them to be a production of Java. The author of the *Sihah*, who died in 1006, describes Kabábeh as a certain medicine of China. Ibn Sina, about the same time, notices it as having the properties of madder, but a more agreeable taste, and states that it is said to possess hot and cold properties, but is really hot and dry in the third degree, a good deobstruent, and useful as an application to putrid sores and pustules in the mouth; it is also good for the voice and for hepatic obstructions; a valuable diuretic, expelling gravel and stone from the kidneys and bladder. He concludes by stating that the application of the saliva, after chewing it, increases the sexual orgasm. Later Mahometan writers have similar accounts of Kabábeh, and say that it is called Hab-el-arús, "bridegroom's berry," and that Greek names for it are Mahilyun (μάχλόν?), and Karfiyun, evidently a corruption of καρπησιον, the name of an aromatic wood mentioned by Paulus Ægineta. It appears that cubebs were at one time known as *Fructus carpesiorum* in Europe. In the Rája Nirghanta, which was written about 600 years ago, cubebs appear under the name of Kankola, and the same name appears in the Hindi and Marathi Nighantas. Madanpal gives Katuka-kola, "pungent pepper," as a synonym for it. All the Sanskrit names appear to be of comparatively recent origin. The authors of the *Pharmacographia* draw attention to the fact that the action of cubebs upon the urino-genital organs, though known to the old Arabian physicians, was unknown to modern European writers on Materia Medica at the commencement of the present century. According to Crawfurd, its importation into Europe, which had long been discontinued, recommenced in 1815, in consequence of its medicinal virtues having been brought to the knowledge of the English medical officers serving in Java, by their Hindu servants. (*Op. cit., 2nd Ed.*, p. 585.) In earlier times cubeb pepper was used in Europe as a spice, as it still is, to some extent, in the East.

Description.—The fruits are elevated on a kind of stalk, formed from the contraction of the base of the fruit itself, so that they are not really but only apparently stalked.

The dry berries are spherical, wrinkled, of a brown colour, and are easily distinguished from black pepper by the pedicel at their base; beneath the pericarp is a nut which contains the seed. The albumen is white and oily. As the fruit is gathered when immature, the drug usually consists of little else than the pericarp. The mature fruit which is sometimes met with in the Indian Bazars should be rejected.

Microscopic structure.—The pericarp consists of an epidermis, beneath which is an interrupted row of small thick-walled cells. Within this the parenchyme is composed of cells containing starch and oil; in the latter, bundles of needle-shaped crystals of cubebin may be observed; lastly, the innermost layer of the pericarp is formed by several rows of tangentially extended cells containing essential oil. The nut is yellow and brittle. The seed when present is seen to contain crystals of cubebin.

Chemical composition.—The most obvious constituent of cubebs is the volatile oil, the proportion of which yielded by the drug varies from 4 to 13 per cent. The oil, when freshly distilled, is slightly greenish, but becomes colourless on rectification. It has the odour of cubebs, and a warm aromatic comphoraceous taste. Its density varies between 920 and 936 at 15° C. The causes of the great variation in the yield of oil may be found in the constitution of the drug itself, as well as in the alterability of the oil, and the fact that its prevailing constituents do not begin to boil below 264° C. Cubeb oil was shown by Oglialoro to be a mixture of a turpene boiling at 158° to 163°, which is present to a very small amount, and two oils of the formula $C^{15}H^{24}$, boiling at 262° to 265° C. One of the latter deviates the plane of polarization strongly to the left, and yields a crystalline compound, $C^{15}H^{26}Cl^2$, melting at 118° C. The other hydrocarbon is less lævogyrate, and does not combine with HCl. (*Deut. Chem. Ges. Ber.*, viii., 1357.) Cubeb oil mixes with glacial acetic acid in all proportions; iodine gives a violet coloration without perceptible reaction; with nitric acid it becomes opaque, and on heating a pale red tint is afforded. (*Brannt.*) One part of oil, diluted with about 20 parts of bisulphide of carbon, assumes at first a greenish, and afterwards a blue coloration, if one drop of a mixture of equal weights of concentrated sulphuric and nitric acids is shaken with the solution. The oil distilled from old cubebs, on cooling after a time, is stated to deposit large, transparent, inodorous octohedra of *camphor of cubebs*, $C^{30}H^{48}+2OH^2$, belonging to the rhombic system, which melt at 65°, and sublime at 148°. But the authors of *Pharmacographia* failed to obtain crystals after keeping the oil of fresh cubebs for two years in contact with water, to which a little nitric acid had been added.

Another constituent of cubebs is *Cubebin*, crystals of which may sometimes be seen in the pericarp even with a common lens. It was discovered by Soubeiran and Capitaine in 1839; it is an inodorous substance, crystallizing in small needles or scales, melting at 125°, having a bitter taste in alcoholic solution. It dissolves freely in boiling alcohol, but is mostly deposited upon cooling; it requires 30 parts of cold ether for solution, and is also abundantly soluble in chloroform. Flückiger and Hanbury found this solution to be slightly lævogyre, and to turn red on addition of concentrated sulphuric acid. If the solution of cubebin in chloroform is shaken with phosphoric anhydride, it turns *blue*, and gradually becomes red on absorption of moisture. Cubebin is nearly insoluble in cold, but slightly soluble in hot water. Bernatzik (1866) obtained from cubebs 0·40 per cent. of cubebin, Schmidt (1870) 2·5 per cent. The crystals, which are deposited in an alcoholic or ethereal extract of cubebs, consist of impure cubebin. Cubebin is devoid of any remarkable therapeutic action; its composition, according to Weidel (1877), answers to the formula $C^{10}H^{10}O^{3}$; by melting it with caustic potash, it is resolved into acetic and protocatechuic acids.

The resin extracted from cubebs consists of an indifferent portion nearly 3 per cent., and of *Cubebic Acid*, amounting to about 1 per cent. of the drug. Both are amorphous, according to Schmidt, like the salts of cubebic acid. Bernatzik, however, found some, as the barium salt, to be crystallizable. Schulze (1873) prepared cubebic acid from the crystallized sodium-salt, but was unable to obtain it crystalline. The resins, the indifferent as well as the acid, possess the therapeutic properties of the drug. Schmidt further pointed out the presence in cubebs of gum (8 per cent.), fatty oil, and malates of magnesium and calcium. The yield of ash, according to Warnecke, is 5·45 per cent.

Commerce.—Bombay is supplied with the drug from Singapore. There is a good demand for it, and the consumption in native practice appears to be increasing. Value—Formerly cubebs was obtainable in the Indian markets at from 4 to 5 annas per lb., but for the last eight years the price has been seldom less than Re. 1 per lb.

PIPER BETLE, *Linn.*

Fig.—*Wight Ic., t.* 2926; *Miq. Ill. Pip., t.* 39; *Bot. Mag., t.* 3132; *Rheede, Hort. Mal. vii., t.* 15. Betle Pepper (*Eng.*), Poivrier de Betel (*Fr.*).

Hab.—Cultivated in the hotter parts of India, Ceylon, and Malay Islands. The leaves.

Vernacular.—Pán (*Hind., Beng., Guz., Mar.*), Vettilai (*Tam.*), Nága-valli (*Tel.*), Vetrila (*Mal.*), Viledele (*Can.*).

History, Uses, &c.—According to the Hitopadesa, the Betle-leaf (támbúla) has thirteen properties (Támbúlasya trayodasha gunáh svarge'pi te durlabháh). It is sour, bitter, heating, sweet, salt, astringent; it expels flatulence (vataghna), phlegm (kaphanàsana), worms (krimihara); it removes bad odours; beautifies the mouth, cleans it, and excites voluptuous sensations. According to Hindu tradition, the plant (Nága-valli) was brought from heaven by Arjuna, who stole a branch of it, which he planted on his return to earth. The leaves with Betle-nut and spices form the *vira*, or *pán-súpári*, so much used by the natives of India as a token of civility or affection. It is also given in confirmation of a pledge, promise, or betrothal, and, among the Rajpoots, is sometimes exchanged as a challenge; thus the expression *bira uthana* signifies "to take up the gauntlet," or take upon oneself any enterprise; *bira dalna*, "to propose a premium" for the performance of a task: the phrase originated in a custom that prevailed of throwing a *bira* into the midst of an assembly, in token of an invitation to undertake some difficult affair; for instance, in the first story of the "Vetalapanchavinshati," the king, when he sends the courtesan to seduce the penitent who was suspended from a tree, nourishing himself with a smoke, gives her a *bira*. *Bira dena* signifies "to dismiss" either in a courteous sense or otherwise. A *bira* is sometimes the cover of a bribe, and a *bira* of seven leaves (*sat pan ka bira*) is sent by the father of the bride to the bridegroom as a sign of betrothal. At marriages the bride or bridegroom places a *viri* or cigarette-shaped *vira* between the teeth, for the other party to partake of by biting off the projecting half; one of the tricks played on such occasions is to conceal a small piece of stick in this *viri*, so that the biting it in two is not an easy matter.

The betle-leaf was probably the Malabathron or Indian leaf of the Greeks, sometimes called simply "leaf" (φυλλόν), and sold in rolls in a dried state. Dioscorides speaks of its being threaded on strings to dry, a practice which, before the introduction of steam carriage by sea, was common in Bombay among the Indian traders who sent the leaves to their friends at foreign ports. The passage in Dioscorides ἐν τω μελανίζειν τε ἄθραυστον καὶ ὁλόκληρον is probably corrupt, and should be as suggested by his commentator, M. Vergilius, ἐν τω μαλακίζειν τε ἄθραυστον καὶ ὁλοκληρον, a reading which he found in one manuscript. As regards the fabulous growth of Malabathron as recorded by Dioscorides, it may possibly have originated from a confused account of the method of ripening betle leaves followed in some parts of India. The author of the *Makhzan* states that the leaves, which, when plucked, are always green, are packed in a large kind of basket and covered with rice or wheat straw. A hole is then dug in the ground, of the size of the basket, and a fire lighted in it until the ground becomes warm. The fire is then removed, and the basket of leaves is placed in the hole and covered with stones or any heavy weight so as to press the leaves together; it is kept in this position for 24 hours, and after removal the basket is exposed to the night dew, if it is the hot season, or kept in a warm place, if it is the cold season, until the leaves are of a pale yellow colour and become brittle. That Malabathron was not a cinnamon leaf, is, we think, clear from Dioscorides in his chapter on Cassia, describing its leaves as like those of the pepper plant, thus showing that he was acquainted with cinnamon leaves as distinct from Malabathron.

Ibn Sina describes Támbúl as cold and dry, astringent and desiccative, and notices its use by the Hindus. The author of the *Makhzan-el-Adwiya*, who wrote in India, gives a full account of the different varieties of Betle-leaf produced by cultivation; of the method of ripening the leaves for the market; and of their properties and uses.

Dutt (*Hind. Mat. Med.*, p. 244) has the following concise account of their uses:—"The leaves of this creeper are, as is well known, masticated by the natives of India. The poorer classes make their packet of betle with the addition of lime, catechu, and betle-nuts. The rich add cardamoms, nutmegs, cloves, camphor, and other aromatics; betle-leaf thus chewed acts as a gentle stimulant and exhilarant. Those accustomed to its use feel a sense of langour when deprived of it. The ancient Hindu writers recommend that betle-leaf should be taken early in the morning, after meals and at bed-time. According to

Susruta, it is aromatic, carminative, stimulant, and astringent. It sweetens the breath, improves the voice, and removes all foulness from the mouth. According to other writers it acts as an aphrodisiac. Medicinally it is said to be useful in diseases supposed to be caused by deranged phlegm, and its juice is much used as an adjunct to pills administered in these diseases, the pills being rubbed into an emulsion with the juice of the betle-leaf and licked up. Being always at hand, *Pán* leaves are used as a domestic remedy in various ways. The stalk of the leaf smeared with oil is introduced into the rectum in constipation and tympanitis of children, with the object of inducing the bowels to act. The leaves are applied to the temples in headache for relieving pain, to painful and swollen glands for promoting absorption, and to the mammary gland with the object of checking the secretion of milk. *Pán* leaves are used as a ready dressing for foul ulcers, which seem to improve under them."

The spittle, after chewing *pán súpári*, is red, and is freely ejected by natives, preferably over recently white-washed walls; the dry stains are often mistaken by the police for blood stains, and pieces of plaster, leaves, grass, &c., thus stained have frequently been forwarded to the Chemical Examiner, Bengal, for detection of blood!

Of late years the medicinal properties of betle leaves have been investigated in Europe. Dr. Kleinstuck of Zwatzen, near Jena, has found that the essential oil is of much use in catarrhal affections, inflammations of the throat, larynx and bronchi; it has an antiseptic action. He has also used it in diphtheria as a gargle and by inhalation. The dose is one drop in one hundred grams of water. In India the juice of four leaves may be used similarly diluted.

Cultivation.—The betle garden (*pán-mala*) is a work of art. The best site is the well-drained alluvial bank of a river or stream. The vine is rather fond of an iron soil, but lime, salt, or soda are fatal to it. The well must last throughout the year, be perfectly sweet, and not more than forty feet deep, otherwise the cost of raising the water eats up the greater part of the profits. The betle-leaf, it is said, cannot be grown from channel water, which is very cold. After the site has been chosen, the next point is to fence it from cattle, thieves, and strong winds. First is an outer line (*kumpan*) of substantial wicker-work, split bamboos, Zizyphus twigs, or other pliable material. Inside of this fence is a thick milk-bush hedge.* Then comes a belt of the large castor plant, and last of all, a row of plantains. The garden is laid out in an invarying pattern. The whole, crosed by water channels and roads, forms beds of different shapes and sizes. Each bed, known by a particular name, such as the *cheritang*, the *bertang*, and the *váfa*, is stocked with a certain number of vines, so that the outturn and other particulars of a garden can be calculated with great nicety. After the ground has been laid out and properly levelled, tree seeds are sown for the vines to train on. Round the edge of each bed is a line of *shevri* (*Sesbania ægyptiaca*), and in the centre from two to three feet apart, the seeds of *hadga* (*Sesbania grandiflora*) and *pangára* (*Erythrina indica*), and from four to six feet apart, single seeds of the *nimb* (*Melia Azadirachta*), are planted. In addition to these, the *popai* (*Carica Papaya*), singly, and plantains in pairs are dotted about, according to the amount of shade required. These seeds are sown in the first week in June (*mriga nakshatra*), and after that, hand-weeding and watering every eight days is all that is wanted up to the end of December (*pushya nakshatra*), when the nurse-trees are eighteen inches to two feet high, or large enough for planting the vines. From the tops of the best ripened shoots, in the old plantations, seven-inch cuttings are taken. They are first made into small bundles, wrapped in plantain leaves, soaked in the water they have been accustomed to, carried to the new plantation, soaked in the new water, and all but the tips buried in the ground. For some time water is given daily; later on once in two days; and afterwards, except during the hot months when it is given every other day, once in six days. From each unburied tip a shoot springs. When they are a few inches long, the shoots are led up the stems of the nurse-trees, and lightly tied with strips of a dried sedge (*path*), so elastic that, without untying it, the pressure of the growing vine keeps it loose. When the vine has grown to the proper height, it is turned back and trained down until it reaches the ground, where it is layered in the earth and again turned up. This is repeated until the tree-stem is fully clothed with vines, when the whole is firmly tied with the dried reeds of the *larála*[*] grass. After this the management of the plantation closely resembles the cultivation of the grape vine in Southern Europe. Leaf-picking may be begun eighteen months after planting, but in the best gardens it is put off till the end of the second year. The leaves may be gathered green and ripened artificially, or they may be left to ripen on the vine, though this reduces their value. The leaf-picker uses both hands, the thumbs sheathed in sharp-edged thimble-like plates, which nip the leaves clean off without wrenching the plant. The vine-grower is either himself a leaf-dealer, or he sells his crop in bulk to a leaf-dealer. Their table of measures is: 400 leaves make a *kavli*; 44 *kavlis* a *kurtan*; and four *kurtans* or 70,400 leaves an *ojhe*. In retail the leaves are sold at from 1—2 annas the hundred. (*Khandesh Gazetteer*, p. 174.)

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* **Euphorbia neriifolia.**

Description.—The leaves are about five inches long, broadly ovate, acuminate, obliquely cordate at the base, 5 to 7 nerved, coriaceous, and glossy on the upper surface: they have a burning, aromatic and bitter taste.

Chemical composition.—D. S. Kemp of Bombay (1885), by distilling the fresh leaves with water, obtained two pale yellow essential oils, one heavy and the other light, both having the peculiar odour of the leaf, but the light oil being more aromatic. These oils oxidised rapidly, losing their characteristic ethereal odour. The heavy oil was freely soluble in alcohol and ether, sparingly so in chloroform. It had a specific gravity of 1·046 at 84° F., and was slightly lævogyre, (a) j = —·54 for a column 100 mm. long. Prof. J. F. Eijkman's results with oil of betle, distilled by himself from fresh leaves, which had been in part reported in 1888, have been communicated to the German Chemical Society (*Berichte*, 1889, pp. 2736–2754). The oil was pale greenish-yellow, became golden-yellow and brown on exposure, was slightly lævogyre, and had the sp. gr. 0·969 at 15° C. Caustic potash removed from the oil *chavicol*, a phenol of sp. gr. 1·030 at 15°C., boiling between 236° and 238° C., and having a peculiar odour, somewhat resembling that of creasote; its composition is $C^9H^{10}O$; its aqueous solution is coloured blue by ferric chloride, the colour disappearing on the addition of alcohol; its constitution is expressed by the formula

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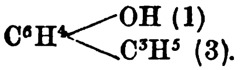
[*] *Scirpus subulatus*, Vahl., and *Cyperus pertenuis*, Roxb., are both known by this name.

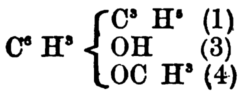


$$C^6H^4 \begin{cases} OH\ (1) \\ C^3H^5\ (3). \end{cases}$$

The crude chavicol seems to contain a small quantity of a phenol of somewhat higher boiling point, and in alcoholic solution becoming blue with ferric chloride. Betle oil, freed from phenol, did not yield, on fractional distillation, a pure compound in sufficient quantity for examination. The fraction between 173° and 176° contained several terpenes, but no pinene, and had a very agreeable lemon-like odour, while a mint-like odour was observed in the fraction between 190° and 220°. From the higher boiling fraction a hydrocarbon, sesquiterpene, was obtained, having a slight odour, boiling at 260° C., and in acetic solution acquiring a deep indigo-blue colour with bromine. Eijkman calls attention to the betle oil obtained by Schimmel & Co. from dried leaves, and shows that the oil did not contain the above compounds to which the fresh leaves owe their characteristic odour, and which must have been dissipated by drying, or oxidised by exposure, or lost by remaining dissolved in the water; the use of steam under pressure may have volatilized more of the high-boiling phenol than is obtainable by ordinary distillation.

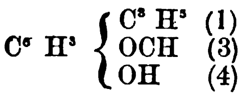
The oil distilled from the dry leaves by Messrs. Schimmel & Co. was a slightly brown-coloured liquid, sp. gr. 1024 at 15°C. It consisted up to about ⅔ or ¾ of a phenol, the boiling point of which in partial vacuum, under a pressure of 12 mm., lay at 131°—132° C.; under ordinary atmospheric pressure it underwent decomposition on boiling. The sp. gr. of the phenol was 1·067 at 15° C. Examination of the oxidation products, acetyl compound and methyl ether, showed that this compound was not eugenol, but an isomer, the composition of the new compound (iso-eugenol) and of eugenol being represented as follows:—

Iso-eugenol.



$$C^6 H^3 \begin{cases} C^3 H^4 & (1) \\ OH & (3) \\ OC H^3 & (4) \end{cases}$$

Eugenol.



$$C^6 H^3 \begin{cases} C^3 H^5 & (1) \\ OCH & (3) \\ OH & (4) \end{cases}$$

The second constituent of the oil boiled practically between 250° and 275° C., had a very agreeable tea-like odour, and consisted for the greater part of a sesquiterpene $C^{15} H^{24}$, cubebene, which is characterized by its dihydrochlorate melting at 117°—118° C. (*Berichte von Schimmel & Co.*, 1887.)

At the Narturforscher Meeting in 1888, Professor Eijkman reported that among the constituents of the essential oil distilled from fresh betle leaves, he had found a characteristic compound, having the odour of the leaves and the constitution of parallylphenol, which he designated "*chavicol.*" About the same time Messrs. Schimmel announced that the phenol present in the higher-boiling factions of the oil distilled from air-dried betle leaves corresponded completely with eugenol, though subsequently they made the modified statement that the phenol obtained by them was not eugenol, but an isomer (*Pharm. Journ.* [3], xix., 803.) With a view to clearing up the apparent contradiction, Prof. Eijkman has re-examined the oil distilled by himself from the fresh leaves, and some distilled from dry leaves by Messrs. Schimmel, with the result of confirming the presence in the former of chavicol, boiling at 236° to 238° C., and in the latter of the isomer of eugenol, boiling at 254° to 255°, which proved to be orthomethoxychavicol (*Berichte*, xxii., 2735). It would seem probable, therefore, that both phenols occur in the leaves, and that chavicol being the more volatile, had practically disappeared from the dried leaves, while the method of distillation adopted by Messrs. Schimmel favoured the more complete removal of the higher-boiling compound. Some experiments made with chavicol are said to have shown it to be a powerful antiseptic, it being five times stronger as a bacteriacide than carbolic acid, and twice as strong as eugenol. (*Pharm. Journ.*, Nov. 30th, 1889.)

A sample of oil distilled from fresh betel leaves in Manila, at the request of Messrs. Schimmel, is described as of a golden yellow colour, possessing a pronounced odour of betelphenol and having a specific gravity of 1·044 at 15° C. The phenol was separated from the oil by the method of Bertram and Gildemeister, and during the purification by distillation at a pressure of 11 mm. it passed over quite regularly between 128° and 129°, a behaviour that pointed to a homogeneous body. By treatment of the phenol with benzoyl chloride a benzoyl compound was obtained that crystallized in scales and melted at 50°. It was evident that this was not a mixture of benzoyl compounds, as the portion that crystallized first had the same melting-point as that which crystallized last; it followed, therefore, that it represented no other phenol than betelphenol. Other constituents occur in this oil only in a small quantity, and of these, to judge from the boiling point, terpenes form only a small fraction. The results of the examination of betel oil up to the present time may therefore be summed up as follows:—

(1) Oil distilled from fresh leaves from Java (Eijkman), contained besides terpenes and other bodies, chavicol and betelphenol.

(2) Oil from dried Siam leaves consisted of sesquiterpene and betelphenol.

(3) Oil distilled from fresh leaves (Java) contained terpenes, betelphenol and a small quantity of another phenol (probably chavicol), the nature of which could not be determined, from want of material (melting point of the benzoyl compound 72°-73°).

(4) Oil from fresh leaves distilled in Manila contained no other phenol than betelphenol.

Betelphenol was contained in all the oils, whether derived from Java, Siam or Manila, or from fresh or dry leaves; it would therefore appear to be a characteristic constituent of betle oil. (*Berichte v. Schimmel & Co.*, Oct. 1891.)

MYRISTICEÆ.

MYRISTICA FRAGRANS, *Houtt.*

Fig.—*Bentl. and Trim.*, *t.* 218; *Reichb. Ic. Exot.*, *t.* 276-277; *Nees, Pl. Med.*, *t.* 133; *Rumph. Herb. Amb.*, *ii.*, *t.* 4. Nutmeg (*Eng.*), Muscade (*Fr.*), Mace (*Eng.*), Macis (*Fr.*).

Hab.—Moluccas. Cultivated in Penang, Malay Island, and Zanzibar. The seeds and arillus.

Vernacular.—Nutmegs—Jaiphal (*Hind.*, *Beng.*, *Guz.*, *Mar.*), Jádikai (*Tam.*), Jaji-kaya (*Tel.*), Jájikayi (*Can.*), Játikka (*Mal.*). Mace—Javitri, Jápatri (*Hind.*), Jádipattiri (*Tam.*), Jápatri (*Can.*, *Tel.*), Játipattiri (*Mal.*), Jotri (*Beng.*), Jáyapatri (*Mar.*), Javantari, Jápatri (*Guz.*).

History, Uses, &c.—Natmegs, in Sanskrit Játi and Játiphala, are mentioned by Susruta, and in the Nighantas bear various synonyms, such as Játi-kosha, Játi-sára, Shálúka, and Majja-sára; they are considered to be hot, digestive, carminative, expectorant and anthelmintic. Mace is called Játi-pattri, and is said to have similar properties. Both of these spices probably became known in India through the Hindu colonists in Java and the Eastern Islands. From India they would appear to have reached Persia and Eastern Europe. The authors of the *Pharmacographia* remark that nutmegs were probably known at Constantinople about the year 540. The Arabs evidently first became acquainted with nutmegs through the Persians, as their name Jouz-bawwa is a corruption of the Persian Gauz-i-buya, "fragrant nut." Masudi, who travelled in the East in A.D. 916—920, discovered that they were obtained from the Zerbád Islands. Ibn Sina describes both nutmegs and mace (Basbáseh). Edrisi, who wrote in the middle of the 12th century, mentions both nutmegs and mace (Basbáseh) as articles of import into Aden. By the end of the 12th century both of these spices were well known in Continental Europe.

Mir Muhummad Husain says that the Dutch keep the trade in their own hands, but that he has heard that the tree is now cultivated in Sounda in Southern India. Whether he was rightly informed with regard to Sounda, we are unable to say. But that his information was substantially correct, there can be no doubt, as Ainslie tells us that in his time the true nutmeg tree was growing in the Tinnevelly District, and produced pretty good fruit. The tree has also been introduced into Ceylon and Zanzibar, and appears to flourish in the warm moist climates of those islands.

Mahometan doctors describe nutmegs and mace as stimulating, narcotic, digestive, tonic, and aphrodisiac, useful in choleraic diarrhœa, especially when roasted; also in obstructions of the liver and spleen. A paste made with nutmegs is used as an external application in nervous headache, palsy, &c.; applied round the eyes it is thought to strengthen the sight. The expressed oil of nutmegs is imported into India from Banda, and is known as Jawitri-ka-tel (oil of mace). It was formerly exclusively brought into European commerce *viâ* Holland, in oblong cakes having nearly the form of common bricks, but somewhat smaller, and packed in monocotyledonous leaves, commonly called "flag leaves." At the present time much of the oil is manufactured in Europe, and put up in the same shape, but packed in paper. When discoloured and hardened by age, the oil is called "*Banda soap.*" Oil of mace is manufactured by exposing imperfect and broken nutmegs, reduced to a paste and enclosed in a bag, to steam, and then pressing the bag between heated iron plates. The yield is about 20 to 23 per cent. (*Brannt.*) The bark of the tree is astringent. (*Pereira, Mat. Med.*, ii., p. 475.) We have found nutmegs and their essential oil a valuable adjunct to other drugs in the treatment of diarrhœa and dysentery; they appear to relieve the pain.

Description.—The following excellent description of the nutmeg fruit is taken from the *Pharmacographia* :—" The fruit of *Myristica fragrans* is a pendulous, globose drupe, about 2 inches in diameter, and not unlike a small round pear. It is marked by a furrow which passes round it, and by which at maturity its thick fleshy pericarp splits into two pieces, exhibiting in its interior a single seed, enveloped in a fleshy foliaceous mantle or arillus, of fine crimson hue, which is mace. The dark-brown, shining ovate seed is marked with impressions corresponding to the lobes of the arillus; and on one side, which is of paler hue and slightly flattened, a line indicating the raphe may be observed.

The bony testa does not find its way into European commerce, the so-called nutmeg being merely the kernel or nucleus of the seed. Nutmegs exhibit nearly the form of their outer shell, with a corresponding diminution in size. The London dealers esteem them in proportion to their size, the largest, which are about one inch long by $\frac{8}{10}$ of an inch broad, and four of which will weigh an ounce, fetching the highest price. If not dressed with lime, they are of a greyish-brown, smooth yet coarsely furrowed and veined longitudinally, marked on the flatter side with a shallow groove. A transverse section shows that the inner seed coat (endopleura) penetrates into the albumen in long, narrow brown strips, reaching the centre of the seed, thereby imparting the peculiar marbled appearance familiar in a cut nutmeg. At the base of the albumen, and close to the hilum, is the embryo, formed of a short radicle with cup-shaped cotyledons, whose slit and curled edges penetrate into the albumen. The tissue of the seed can be cut with equal facility in any direction. It is extremely oily, and has a delicious aromatic fragrance, with a spicy rather acrid taste." The expressed oil of nutmeg is of the consistence of tallow, but more friable, orange-coloured, and of a fragrant, spicy taste and odour. It has a sp. gr. of ·990 (*Brannt*).

Microscopic structure.—The brown covering of the nutmeg is formed by the endopleura, which also dips in and forms numerous processes which divide the albumen in every direction; it is composed of soft-walled brown cells, which on the external surface are small and flat, but much larger in the processes already mentioned. The cell-structure of the albumen is loaded with starch and fatty matter, some of which is crystalline.

Herr A. Tschirch states that the aril of *Myristica fragrans* furnishes a good illustration of the presence of amylodextrin as a normal cell-content in the place of starch. It is distinguished from true starch by being stained reddish-brown instead of blue by an aqueous solution of iodine. The grains of amylodextrin are from 2 to 10 μ in diameter, and do not appear to contain even a nucleus of starch. They have usually somewhat the form of a rod, and are often curved or coiled; less often they are roundish or disc-shaped; they do not usually exhibit any evident stratification.

Chemical composition.—Nutmegs contain from 2 to 8 per cent. of volatile oil, 25 to 30 per cent. of fat, starch, protein compounds, &c. The most volatile portion of the oil, after treatment with sodium, was found, by Cloëz, to be a lævogyre hydrocarbon, $C^{10}H^{16}$, having the odour of the nut, and boiling at 165° C. It is the *myristicene* of Gladstone, who named the oxygenated portion *myristicol*, $C^{10}H^{14}O$; this is dextrogyre, boils at 224° C., and does not, like menthol and carvol, yield a crystalline compound with H^2S. The *nutmeg camphor* of John, or *myristicin* of Gmelin, which separates sometimes on standing, was ascertained by Flückiger to be myristic acid. From the expressed oil of nutmeg or nutmeg butter, cold alcohol dissolves about 6 per cent. of volatile oil and 24 per cent. of fat, accompanied by brown-yellow resinous matter, which has not been further examined. The remaining pulverulent white fat is *myristin*, $C^3H^5(C^{14}H^{27}O^2)^3$, which crystallizes from hot alcohol or ether and fuses at 31°C. Heintz found the melting-point of *myristic acid* to be 53·8° C. Schmidt and Rœmer found 3 to 4 per cent. of free myristic acid, with a little stearic acid.

The most important constituent of mace is the volatile oil which is present to the amount of about 8 per cent., but occasionally as much as 17 per cent. may be obtained. (*Pharmacographia.*) Schacht found it to consist mainly of a terpene, $C^{10}H^{16}$, called *macene,* which yields a crystallizable compound with hydrochloric acid gas, and appears to be related to, but, by Koller, considered identical with, the myristicene of oil of nutmeg. The oxygenated portion of the volatile oil is still less known than the terpene. Henry found red fat soluble, and yellow fat insoluble, in alcohol, but the 24·5 per cent. residue obtained by Flückiger (*Pharmacographia*) with boiling ether and drying at 100° C. appeared to have consisted solely of resin and semi-resinified volatile oil. The same author obtained with alcohol 1·04 per cent. of uncrystallizable sugar, and with hot water 1·8 per cent. of a body which turned blue, and after drying reddish-violet, with iodine, and is probably intermediate between starch and mucilage. (*National Disp.*) J. Semmler (*Berichte,* 23, 1803) has isolated, by fractional distillation from mace or rather nutmeg oil, a body possessing the peculiar odour of mace, which he calls *myristicin,* and which has the composition represented by $C^{12}H^{14}O^{3}$. The correctness of the formula was controlled by the preparation of a bromine derivative dibrom-myristicin, $C^{12}H^{14}Br^{2}O^{3}$, which melts at 105° C.

According to Warnecke, powdered nutmegs yield 41·25 per cent. of fat when boiled for two hours in a reflux condenser with benzol, and the dried residual powder gives 3·77 per cent. of ash. Mace yields 1·39 per cent. of ash, and after removal of 30·13 per cent. of fat, 2·74 per cent.

Toxicology.—The narcotic effects of nutmegs noticed by the old Mahometan physicians have been confirmed by Bontius, Rumphius, Lobel, Schmid and Cullen, and more recent experiments upon man and animals agree in showing that they have a narcotic and intoxicating action. In a case related by Cullen, two drachms of powdered nutmegs produced drowsiness, which gradually increased to complete stupor and insensibility. The patient continued for several hours alternately delirious and sleeping, but ultimately recovered.

Commerce.—Value, Re. 1-4-0 to Re. 1-8-0 per lb. The nutmegs imported into India run from 100 to 130 to the pound; the larger seeds never make their appearance in this market. Indeed the native retail dealers prefer small seeds, as they buy by weight and sell by number.

MYRISTICA MALABARICA, *Lamk.*

Fig.—*Bedd. Fl. Sylv., t.* 269; *Rheede, Hort. Mal.* iv., *t.* 5.

Hab.—Concan, Canara, N. Malabar. The seed and arillus.

Vernacular.—Rán-jaiphal, Rámphal (*Mar.*), Panam-palka (*Mal.*). The Mace—Rámpatri (*Mar., Guz.*).

History, Uses, &c.—This drug does not appear to have been known to the older Hindu and Mahometan medical writers, but the following extract from the *Makhzan-el-Adwiya* seems to apply to it. Speaking of true nutmegs, the author says:—'Latterly the English have discovered a kind of nutmeg in Southern India, which is longer than the true nutmeg and softer, but is much inferior to it in oiliness, odour, and medicinal properties." (*Makhzan*, article "*Jouz-bawwa.*")

It is the *Nux myristica mas* of Clusius, and the *Panam-palca* of Rheede, who says that the Turkish and Jewish merchants use the nutmegs and mace for adulteration. Rumphius (i.,185) notices it under the name of *Mannetjes-nooten*, and states that it is used by the Javanese and Malays as a remedy for headache and as an aphrodisiac, and is worn round the neck as a protection from boils. It is also used by the Indians in Amboyna, combined with opium and roasted unripe plantains, in dysentery.

According to the editor of the *Pharmacopœia of India*, the seed is used medicinally in the Madras Presidency; it yields, when bruised and subjected to boiling, a considerable quantity of concrete oil, analogous to expressed oil of nutmeg, which is said to be an efficacious application to indolent ulcers, allaying pain and establishing healthy action. An ointment may be made by melting it with sweet oil. The seeds are used for similar purposes in Bombay in the form of a *lép*, and the oil is also extracted.

Recently, the arillus, under the name of '*Bombay mace*,' has made its appearance in the European markets, for the purpose of adulterating true mace. (Confer. *A. Tschirch in Pharmaceut. Zeitung*, 1881, No. 74.) In Bombay it is used as a spice.

Description.—*M. malabarica* bears an oblong, tawny, hairy fruit, 2½ to 3 inches long, with a lucumose arillus, the lobes of which are twisted and folded into a cone at the top, and are longer and thinner than those of true mace. The arillus is of a dark brownish-red colour, and on the inside has adhering to it a thin papery membrance of a light-brown colour. The shell is hard and brittle, and contains an elongated kernel resembling a nutmeg, and from 1¼ to 2 inches long; when cut in two it is seen to have the same ruminated structure, but the odour is fruity, with hardly any aroma. Similarly, the mace is deficient in odour and flavour.

Microscopic structure.—The epidermal cells of the arillus are radially elongated, narrow, and twice as high as those of true mace, which are tangentially elongated; their walls show the cellulose reaction with iodine and sulphuric acid, and with chloride of zinc and iodine swell and turn faintly blue. The oil cells are very numerous, located near the epidermis on both sides, often close together in groups of two or three, oval in shape, somewhat radially elongated, and contain a dark-yellow, usually, resinified oil, frequently also a brownish resin. (*A. Tschirch.*) The external covering of the seed is formed by the compressed cells of the endopleura, and is thicker than that of the true nutmeg; the processes which penetrate the albumen are composed of very large cells loaded with a viscid reddish-brown substance, which has an astringent and somewhat acid taste. The albumen is composed of large cells loaded with starch; some of the cells and their contents are of a reddish-brown colour. There is no crystalline fat visible.

Toxicology.—Rumphius relates that in 1683 a minister of Amboyna was given by his wife three roasted nuts, in mistake for nutmegs, to cure a chronic diarrhœa; in a few hours he became giddy, making strange gestures and talking wildly, nor did he get any relief until he had taken several cups of tea and been blooded. He then slept profoundly and perspired very freely. On waking, no bad effects remained, and the diarrhœa had ceased. Rumphius remarks that if he had taken three real nutmegs, he would have suffered much more.

Commerce.—Rámpatri is now worth about Rs. 10 per maund of 37½ lbs.; formerly it was much cheaper. The nutmegs fetch Rs. 2 per maund of 37½ lbs. According to Dr. Hefelmann, the adulteration of powdered mace in Germany generally consists in the addition of Bombay mace, or of other vegetable material (leguminous fruits) coloured with turmeric. The presence of the latter is shown by the presence of starch cells which are not present in mace. Bombay mace may be detected by boiling the suspected sample with alcohol and filtering through a white filter; in the case of pure mace, the filter is stained a faint yellow, but in the presence of Bombay mace, the filter, especially the edge, is coloured red. Another more delicate test is to add Goulard's extract to the alcoholic filtrate; with pure mace only a white turbidity is occasioned, but when Bombay mace is present, a red turbidity is obtained. The reaction given by turmeric is similar, but it may be distinguished from that of Bombay mace in the following manner:—A strip of filter paper is saturated with the alcoholic solution, the excess of fluid removed, and the strip drawn through a cold saturated solution of boric acid; when Bombay mace is present, the paper remains unchanged, but in the presence of turmeric it turns orange-brown. If a drop of potassium hydrate solution is now placed on the strip of paper, it causes a blue ring if turmeric is present, and a red ring if the adulterant is Bombay mace.—(*Pharm. Zeit.*, 1891, 122.)

LAURINEÆ.

CINNAMOMUM CAMPHORA, *Nees.*

Fig.—*Bentl. and Trim., t.* 222; *Woodv. Med. Bot., t.* 236; *Nees, t.* 130; *Berg. et Sch., t.* 10, *e.*; *Wight Ic., t.* 1818. Camphor (*Eng.*), Camphre (*Fr.*).

Hab.—China, Japan. Camphor and Oil of Camphor.

Vernacular.—Káfúr (*Hind.*), Karppúram, Shúdan (*Tam.*), Karpúram (*Tel.*, *Mal.*), Karpura (*Can.*), Kápúr, Káphúr (*Beng.*), Kápúr (*Mar.*, *Guz.*).

History, Uses, &c.—As has been already mentioned (see article "Dryobalanops"), Sanskrit writers, under the name of Karpura, speak of two kinds of camphor, Pakva and Apakva. It is generally supposed that the former term, which means prepared by the aid of heat, refers to ordinary commercial camphor obtained from the wood of *C. Camphora*. The researches of Flückiger and Hanbury show that the only camphor known in early times was that found in the trunk of *Dryobalanops aromatica*. Early Chinese writers only speak of *C. Camphora* as producing a valuable wood, and we have no information as to the date of the first extraction of camphor from it. Garcia d'Orta, who wrote at Goa about the middle of the sixteen century, was well acquainted with both kinds of camphor, and mentions that the China camphor is the only kind exported to Europe. The medicinal uses to which camphor is put in the East have been already noticed under "Dryobalanops." With the exception of a small quantity of refined camphor imported from Japan, the bulk of the drug used in India is imported in the raw state and resublimed in the country. The process of resublimation is a peculiar one, the object being to get as much interstitial water as possible into the camphor cake. The vessel used is a tinned cylindrical copper drum, one end of which is removable; inte this is put 14 parts of crude camphor and 2½ parts of water; the cover is then luted with clay, and the drum being placed upon a small furnace made of clay, is also luted to the top of the furnace. In Bombay four of these furnaces are built together, so that the tops form a square platform. The sublimation is completed in about three hours; during the process the drums are constantly irrigated with cold water. Upon opening them a thin cake of camphor is found lining the sides and top; it is at once removed and thrown into cold water. Camphor sublimed in this way is not stored, but distributed at once to the shopkeepers before it has time to lose weight by drying. It is sold at the same price as the crude article, the refiner's profit being derived from the introduction of water. Experiments by Clautrian (*Berichte*, xxiv., 2612) have proved that camphor possesses considerable hygroscopic properties which are not shared by thymol. 40 grains of camphor will absorb ·054 gram of water from air saturated with aqueous vapour at 16°C. The absorption of moisture by camphor would appear to be a purely physical phenomenon. Both China and Japan crude camphor is imported into Bombay, but the latter is preferred, as it is cleaner. From Japan is also imported refined camphor in large square cakes an inch and a half thick, with a hole in the centre; it is nearly equal in quality to that refined in Europe. The method of obtaining crude camphor in Japan will be found fully described by H. Oishi in the *Journ. Soc. Chem Ind.*, 1884, p. 353. Camphor is largely used in India in performing the *árti* (आरती), a ceremony performed in adoration of some god by waving, in a circle before the image, a platter containing a five-wicked burning lamp, flour, and incense; the lamp being fed with camphor. The same rite, only substituting a bridegroom for the idol, is called *árta*, and is performed on the arrival of the bridegroom at the house of the bride. In Sanskrit this light is called आरात्रिक (árátrika).

Description.—Crude China camphor is in small dirty-white or brown grains, more or less moist from the presence of water; it arrives in tin-lined boxes which hold one quintal. Crude Japan camphor is also in grains, which often adhere together in masses ; it is dry and often quite free from discoloration; sometimes it has a pinkish tinge. It is imported in double butts.

Refined Japan camphor is imported in tin-lined cases, which hold about 90 lbs. Bombay refined camphor is in porous cakes a quarter of an inch thick, and contains much water. Owing to the method of preparation already described, the cakes have no particular form.

Chemical composition.—Camphor, $C^{10}H^{16}O$, by treatment with various reagents, yields a number of interesting products: thus, when repeatedly distilled with chloride of zinc or anhydrous phosphoric acid, it is converted into *Cymene* or *Cymol*, $C^{10}H^{14}$, a body contained in many essential oils, or obtainable therefrom. Camphor, and also camphor oil, when subjected to powerful oxidising agents, absorbs oxygen, passing gradually into crystallized *Camphoric acid*, $C^{10}H^{16}O^{4}$ or $C^{8}H^{14}(COOH)^{2}$, water and carbonic acid being at the same time eliminated. Many essential oils, resins, and gum-resins likewise yield these acids when similarly treated. By means of less energetic oxidizers, camphor may be converted into *Oxy-camphor*, $C^{10}H^{16}O^{2}$, still retaining its original odour and taste. (*Pharmacographia.*) For a full account of the reactions of camphor and its derivatives, the reader is referred to *Watts' Dict. of Chem.*, 2nd Ed., Vol. I., p. 669. The constituents of camphor oil found up to the present are:—

Boiling point.	Constituent.	Formula.
158°—162°	Pinene.	$C^{10}H^{16}$
170°	Phellandrene.	$C^{10}H^{16}$
176°	Cineol.	$C^{10}H^{18}O$
180°	Dipentine.	$C^{10}H^{16}$
204°	Camphor.	$C^{10}H^{16}O$
215°—218°	Terpineol.	$C^{10}H^{17}OH$
232°	Safrol.	$C^{10}H^{10}O^{2}$
248°	Eugenol.	$C^{10}H^{12}O^{2}$
274°	Sesquiterpene.	$C^{15}H^{24}$

Toxicology.—Instances of poisoning by camphor are rare, and, as far as we are aware, no cases have been reported on by Chemical Examiners in India. In large doses camphor causes excitement and delirium with dilated pupils and sometimes convulsions. The mucous membrane of the stomach may be inflamed, but characteristic lesions appear to be absent.

Commerce.—The crude camphor of commerce is largely manufactured in Central China, Formosa, and Japan, and is exported from Canton in chests lined with lead or tinned iron weighing about 1 cwt. each, and from the Japan ports in double tubs which contain about the same quantity. The imports into India have an average annual value of seven lacs of rupees. Refined camphor from Europe now forms an important item in these imports, and some years ago refined camphor was also imported from Japan, but lately it has disappeared from the market. The price of camphor in India is now regulated by the European market, and of late has been extremely variable.

CINNAMOMUM CASSIA, *Blume.*

Fig.—*Bentl. and Trim., t.* 223. China cinnamon, Cassia (*Eng.*), Cannelle de Chine (*Fr.*).

Hab.—China. The bark and essential oil.

Vernacular.—Dárchiní (*Hind.*), Dalchini (*Beng., Mar., Guz.*), Lavanga-pattai (*Tam., Tel., Mal.*), Lavanga-patte (*Can.*).

History, Uses, &c.—Cinnamon and Cassia are mentioned as precious odoriferous substances in the Mosaic writings and by Theophrastus and many other writers of antiquity. The Greek names κινναμώμον and κασία or κασσία are derived from the Phœnician, and are the same as those used by the Hebrews. From Galen we learn that these two spices were of a similar nature, but that cassia was inferior to cinnamon. It is impossible to say for certain what these substances were, but it seems probable that κινναμώμον was Chinese cassia, and κασια the bark of the Indian cinnamon trees. Dioscorides describes several varieties of cinnamon and cassia, and we know that several very distinct varieties of Cinnamon bark are still sold in Indian bazars. That Ceylon cinnamon was not known to the ancients appears to be certain, as the sacred books and old records of Ceylon make no mention of that spice, and when the bark began to be collected in the island is unknown. Kazwini in the 13th century is the first writer who mentions it, and it was not cultivated before 1770.

Cassia, under the name of *Kwei*, is mentioned in the earliest Chinese herbal, said to have been written 2700 B.C., and also in the Chinese classics. In the *Hei-yao-pen-tsao*, written in the 8th century, mention is made of *Tien-chu-kwei*. Tien-chu is the ancient name for India. (*Pharmacographia.*)

The bark of several species of cinnamon growing in different parts of India was known to the ancient Hindus as Tvach, "bark," Guda-tvach, "sweet," or "sugar bark," and the trees producing it as Tvak-sára, "having excellent bark," and Tvaksvádvi, "having sweet-bark." The aboriginal tribes still scrape the bark from these trees and use it to season their food, and have probably done so from prehistoric times.

The Arabians, through whose hands most of the cinnamon of the ancients reached Europe, called the spice Kirfat-ed-dársini, or more shortly Kirfah (the bark *par excellence*), and it is curious to observe that the same word in the corrupted form of Kalfah is still the commercial name of Malabar cassia in Bombay. Dársini is the Arabic form of the Persian Dárchini, and signifies "China tree," *dár* being an old Persian name for a tree; it is therefore probable that the Arabs first obtained the spice from the Persians by the overland route from China. The same name is still current in India for Chinese cinnamon, whereas the Indian bark is properly called *Taj*, a word derived from the Sanskrit *Tvach*, although in popular language Dalchini and Taj are loosely applied to any kind of cinnamon. Ibn Sina follows Dioscorides in his description of the different kinds of cinnamon (*dársini*) and cassia (*salikheh*), but later Mahometan writers are better informed, and are evidently well acquainted with the difference between Ceylon cinnamon, China cassia, and Indian cassia. Haji Zein (1368), speaking of Dárchini, says "the best is that which comes from Ceylon"; concerning Salikheh, he says:—"It is what they call cassia (قشیا), and is the bark of a tree called *Salkh*; there are several qualities, the best is of a reddish colour, thick, and a little bitter to the taste, astringent; when broken it has a fracture like China rhubarb, it is in long folded sticks with a small central hollow like *kirfah*; that which is dark-coloured is bad." Of Kirfah he says, "it has not the sweetness of China cinnamon, and tastes like cloves." In Southern India cassia is called "clove-bark" in several of the vernaculars.

The author of the *Makhzan* remarks:—"From Ceylon to the Dekhan the quality of the cinnamon grown gradually deteriorates, the bark getting thick and mucilaginous."

For the history of cinnamon and cassia in Europe, we would refer our readers to the *Pharmacographia*, where much interesting information will be found.

Cassia and cassia oil imported from China are used medicinally in India in much the the same manner as they are in Europe. Ceylon cinnamon is not an article of commerce in India.

Description.—Chinese cassia arrives in Bombay packed in boxes, which are covered with matting. Each box contains about 60 lbs. The bark is tied up in bundles with strips of bamboo, which weigh about 1 lb. each. The greater portion of each bundle consists of single quills of a light-brown colour, with here and there portions of the external bark still attached; in the centre of the bundle is small collection of fragments of bark and rubbish. Cassia bark is thicker than true cinnamon, but has a similar taste and odour.

Microscopic structure.—Externally the bark is furnished with a suberous layer. Within this is a parenchymatous portion in which may be seen an irregular zone of stony cells. The remainder is mostly composed of liber, in which are situated numerous large cells which contain the essential oil. Laticiferous vessels containing a gummy substance are also present in the parenchyme.

Chinese cassia oil is imported in tins, which contain 12½ catties each; it has a similar odour and colour to oil of cinnamon, but is less agreeable.

Chemical composition.—The authors of the *Pharmacographia* remark: "Cassia bark owes its aromatic properties to an essential oil, large quantities of which are shipped from Canton. In a chemical point of view, no difference can be pointed out between this oil and that of Ceylon cinnamon. The flavour of cassia oil is somewhat less agreeable, and, as it exists in the less valuable sorts of cassia, decidedly different in aroma from that of cinnamon. We find the sp. gr. of a Chinese cassia oil to be 1·066, and its rotatory power in a column 50 mm. long, only 0·1° to the right, differing consequently in this respect from that of cinnamon oil.

"If thin sections of cassia bark are moistened with a dilute solution of perchloride of iron, the contents of the parenchymatous part of the whole tissue assume a dingy brown colour; in the outer layers the starch granules even are coloured. Tannic matter is consequently one of the chief constituents of the bark; the very cell-walls are also imbued with it. A decoction of the bark is turned blackish-green by a per salt of iron.

"If cassia bark (or Ceylon cinnamon) is exhausted by cold water, the clear liquid becomes turbid on addition of iodine; the same occurs if a concentrated solution of iodide of potassium is added. An abundant precipitate is produced by addition of iodine dissolved in the potassium salt. The colour of iodine then disappears. There is consequently a substance present, which unites with iodine; and, in fact, if to a decoction of cassia or cinnamon, the said solution of iodine is added, it strikes a bright blue coloration, due to starch. But the colour quickly disappears, and becomes permanent only after much of the test has been added. We have not ascertained the nature of the substance that thus modifies the action of iodine; it can hardly be tannic matter, as we have found the reaction to be the same when we used the bark that had been previously repeatedly treated with spirit of wine and then several times with boiling ether.

"The mucilage contained in the gum-cells of the thinner quills of cassia is easily dissolved by cold water, and may be precipitated together with tannin, by neutral acetate of lead, but not by alcohol. In the thicker barks it appears less soluble, merely swelling into a slimy jelly."

Oil of cassia, like oil of cinnamon, consists chiefly of *Cinnamic aldehyde*, $C^6H^5(CH)^2COH$, together with a variable proportion of hydrocarbons. The oil easily absorbs oxygen, becoming thereby contaminated with resin and cinnamic acid, $C^6H^5(CH)^2COOH$. In a sample examined by Messrs. Schimmel, the cinnamic aldehyde amounted to 77·7 per cent., the distillation residue to 5·5 per cent., and the cinnamic acid to 0·7 per cent. After one year's free exposure to light, warmth, and air, the percentage of cinnamic acid in this oil had increased to 8·5, and of distillation residue to 12·6, whilst the cinnamic aldehyde had decreased to 68·5, showing that the most important change in the oil is the conversion of cinnamic aldehyde into cinnamic acid, and a slight increase of resinous matter, to the extent of a few per cents., namely, of one part of the 7 per cent. increase of the residue remaining after distillation at 290° C. This point is of importance, as interested parties have attempted to explain the presence of 30 to 40 per cent. of resin in the commercial oil as formed by a natural process. Messrs. Schimmel have shown that in good samples of oil, such as the *Cheong Loong* and *Yan Loong* brands, we may expect to find from 6 to 8 per cent. of soft distillation residue, and in adulterated oils from 20 to 30 or even 40 per cent. of a hard residue, indicating adulteration with colophony. E. Hirschsohn (*Pharm. Zeitsch. f. Russ.*, 1890) has proposed the following simple test for the oil:—If to a solution of cassia oil in 70 per cent., alcohol in the proportion of 1 : 3 is added, drop by drop, to half its volume, a solution (saturated at the temperature of the room) of lead acetate in alcohol of the same strength, it should show no precipitate, otherwise colophony or a similar resin is present. For further information on the adulteration of this oil, the reader is referred to the *Berichte von Schimmel & Co.*, Oct. 1890.

Commerce.—The annual imports of Chinese cassia range from about 15 to 20 thousand cwts. in alternate years. The greater part of it is shipped from Hong-Kong to Bombay, some goes to Calcutta, and a very small quantity to Madras. The following tables show the imports and re-exports for 1884-85 :—

Imports.

Presidency to which imported.	Quantity.	Value.	Country from which imported.	Quantity.	Value.
	Cwts.	Rs.		Cwts.	Rs.
Bombay	12,308	2,01,944	Aden	......	3
Bengal	2,226	41,460	China	13,557	2,24,805
Madras	235	4,940	Straits............	1,212	23,536
Total......	14,769	2,48,344	Total......	14,769	2,48,344

Re-exports.

Presidency from which exported.	Quantity.	Value.	Country to which exported.	Quantity.	Value.
	Cwts.	Rs.		Cwts.	Rs.
Bombay.........	4,675	81,114	Persia	2,785	48,826
Bengal	13	225	Arabia............	980	17,051
Sind	4	55	Turkey in Asia	715	11.956
			Other countries	212	3,561
Total......	4,692	81,394	Total......	4,692	81,394

—(*Dictionary of Econ. Prod. India,* Vol. II., p. 323.)

Chinese cassia fetches in Bombay from 3½ to 4 annas the pound. Malabar cassia about Rs. 5 for the maund of 37½ lbs. Chinese oil sells for about Rs. 2½ per catty.

Taj or **Kalfah,** Indian cassia or cinnamon, is chiefly the product of *C. Tamala,* and *C. iners* and *nitidum,* considered by some botanists to be only coarse forms of *C. zeylanicum,* Breyn. *C. Tamala* is a native of the tropical and subtropical Himalaya from the Indus to Bhotan, and supplies the *Taj* of the N.-W. Provinces, Punjab and Bengal, whilst *C. iners* and *nitidum* supply Southern and Western India. The bark of these trees occurs in flat or slightly quilled pieces, is thicker than the Chinese bark and of a deeper colour; it has a strong cinnamon odour and taste, but is deficient in sweetness. It is now often sent into the market, tied up in bundles, to imitate

China cassia, the outer layer of the bark having been to a great extent removed ; this is probably prepared for exportation as *cassia lignea.* Some trees of *cassia lignea* are cultivated by the Madras Forest Department in the Wynaad. Indian cassia may readily be distinguished from the China bark by its yielding a glairy mucilage when infused in cold water, which gives a ropy precipitate with corrosive sublimate and neutral acetate of lead, but not with alcohol.

No oil is distilled from these barks in India.

Tajpat or **Tamalpatra,** and in Southern India only **Talisha-pattiri,** is the leaf of the species of *Cinnamomum,* already mentioned as yielding *Taj* or Indian cinnamon. The drug is the Tamáli of the Rája Nirghanta, and is considered to be hot and light, and useful for the expulsion of phlegmatic and rheumatic humors; it is prescribed in flatulence and dyspepsia.

Cinnamon leaves are the *Sázaj-i-Hindi* of the Indian Mahometans, and are much used both as a condiment and medicine in India. The author of the *Makhzan* describes them as yellowish, coriaceous, ovate-lanceolate leaves, with five nerves extending from the base to the apex, and says that they are produced by a large tree growing in the mountains of Sylhet, the bark of which is used as cassia. He considers them to be carminative, stimulant, diuretic, diaphoretic, lactagogue and deobstruent.

Description.—The leaves vary a good deal in size, the largest are 6 inches long or more, and 1½ inch broad, oblong, obtuse-pointed, entire, with three principal nerves and two smaller ones which are sometimes quite marginal; the venation between these nerves, which run from base to apex of the leaf, is finely reticulated. The leaves are of an olive-green colour, the upper surface is polished. They have a pleasant odour like a mixture of cloves and cinnamon. Value, Re. 1¼ per 37½ lbs.

According to Professor E. Schmidt (*Chem. Zeit.*, Sept. 26, 1891, p. 1376), the essential oil of cinnamon leaves consists of almost pure eugenol, with a little terpene and cinnamic aldehyde, while the oil from the root also contains eugenol and terpene, together with much safrol and benzaldehyde. Both of these oils, therefore, differ from the essential oil from the bark, which consists of cinnamic aldehyde and terpene.

Kálá Nágkesar.—Under this name the immature fruit of the trees yielding cassia is imported into Bombay from China and Southern India.

Kálá Nágkesar (known in Europe as cassia buds) consists of a small brown mucronate berry, the size of a grain of millet, enclosed in a 6-partite calyx half an inch long, which is articulated to a slender pedicel; the calyx and pedicel are of the dark-brown colour of the clove, and have a strong cinnamon odour and taste. The properties of the spice would appear to be the same as those of cinnamon. Two kinds are found in the Bombay market, Chinese and Malabar; they are used as a spice by the Mahometans. Mohideen Sheriff says that the native druggists in Madras substitute cassia buds for *Nagkesar-ke-phul,* the flowers of *Mesua ferrea* and *Ochrocarpus longifolius;* the latter drugs being never met with in the bazars. For an account of the use of the Chinese buds as a spice in Europe from the 14th century up to the present time, see *Pharmacographia*, 2nd Ed., p. 533. Hamburg in 1876 imported 1,324 cwts. (*Op. cit.*)

Pishin-puttai (Gum-bark). Several mucilaginous barks are sold and used under this name in Southern India. Mohideen Sheriff refers the Madras drug to *Tetranthera Roxburghii* (see next article). A specimen supplied by Dr. Mootoosawmy from Tanjore had a very pleasant and lasting aroma, and appeared to belong to an arboreous cinnamon. It is used for its mucilaginous and demulcent properties in medicine, and also by Mahomedan perfumers for making incense or flavouring-sticks ("Samburany-vathe") from the powdered bark. We have also received three other drugs of this name from Travancore. One was a thick red fibrous bark like that of a Litsæa, and was an article of trade among sugar and jagary makers on the Western Coast. The second was a lighter coloured bark and quite free from odour and taste; this was recognised as *Kydia* *calycina.* The third sample was sent by the Conservator of Forests for Travancore, who supposed it to be from a species of Cordia. It was light coloured, very fibrous and free from odour and taste, and is used in native medicine in the State under its Malyalim name *avi-tholi.* Mucilaginous barks are largely employed in India by arrack makers in regulating the fermentation of toddy and precipitating albuminous matters.

The Tanjore *pishin-puttai* gave no reaction indicating the presence of an alkaloid, but the red bark from Travancore gave marked reactions for *laurotetanine.*

LITSÆA SEBIFERA, *Pers.*

Fig.—*Bot. Reg., t.* 893 ; *Roxb. Cor. Pl. ii., t.* 147. *Syn.: Tetranthera laurifolia,* Jacq.

Hab.—Throughout the hotter parts of India. The bark.

Vernacular.—Maida-lakri (*Hind.*), Mushaippé-yetti, Maida-lakti (*Tam.*), Naramámidi, Méda (*Tel.*), Kukur-chita (*Beng.*), Méda-lakadi (*Mar.*), Maeda-lakari (*Guz.*).

History, Uses, &c.—We have been unable to trace the history of the use of this bark as a medicine. It is one of the best known and most popular of native drugs, being used internally, on account of its demulcent properties, in diarrhœa and dysentery, and externally as an emollient application to bruises, &c. Maida-lakri, as far as we know, is not mentioned by Sanskrit writers, but from the vernacular names it would appear to be used as a substitute for the *Méda* of the ancient Hindu physicians, one of the *Ashtavarga,* and unknown to the modern Hindus. In Bengal *Asvagandha* is used. In Mahometan works it is briefly noticed under the names of *Maghath-i-Hindi* and *Kilz.* The author of the *Makhzan-el-Adwiya* states that it has the same essential properties as Maghath, being resolvent, astringent, and a nervine tonic useful in paralysis. It would appear then to have been adopted by Mahometan physicians in India as a substitute for an Arabian drug called Maghath, the botanical source of which is uncertain.

L. sebifera is called *Miri* by the Maratha peasantry, from the resemblance of its globular fruit to a corn of black pepper. The seed is oily and yields a solid white fat. The leaves have a pleasant odour of cinnamon.

Description.—The bark varies in thickness from $\frac{1}{10}$ to $\frac{3}{10}$ of an inch; externally it has several layers of whitish, scabrous, corky tissue, the remaining portion is of a chocolate brown colour. The odour is feebly balsamic; when placed in water it affords a large quantity of bland mucilage, having a faint agreeable aroma. If the bark is old, the aroma disappears, but the mucilaginous qualities remain unimpaired.

The parenchyma, which is chiefly composed of mucilage cells, contains abundance of reddish-brown colouring matter. There is a zone of stony cells, but no distinctive characteristics.

Chemical composition.—This bark, an authentic specimen of which was supplied by Mr. Hollingsworth of the Madras Medical College, gave, on an air-dried sample, 4·6 per cent. of ash, and 14·2 per cent. of alcoholic extract, affording very strong reactions with alkaloidal tests. On separating the alkaloid it was found to agree with the characters of *Laurotetanine*, an alkaloid which has been discovered by M. Greshoff in three species of Litsæa in Java, and in several other plants of the natural order Laurineæ. Laurotetanine is crystalline, and has a strong tetanic action on animals; it is sparingly soluble in ether, more readily in chloroform. It is precipitated by sodium carbonate from solutions of its salts, but readily redissolves in an excess of potash or soda, and is precipitated by the usual alkaloidal reagents. It gives a dark indigo-blue coloration with Erdmann's reagent, a pale rose-red with pure sulphuric acid, and a reddish-brown with nitric acid. A base, which seems to be identical with laurotetanine, is also found in the varieties of *Tetranthera*, *Notophœbe*, *Aperula*, *Actinodaphne* and *Illigera pulchra*. It is also possible that Laurotetanine is the alkaloid discovered in 1886 by Eijkman in *Haasia squarrosa*, Z. et M. (*Meded. uit S'Lands Plantentuin*, vii., p. 77-101.)

Commerce.—The bark is largely collected in the Central Provinces, and comes to market in large half quills from one to two feet in length and two to three inches in diameter. As met with in the retail shops, it is generally broken into small pieces a few inches in length. Value, Rs. 6 per maund of 41 pounds.

Litsæa Stocksii, *Hook. f.*, in Marathi *Pisi,* is a tree of the hilly districts of the Concan and Canara; when in fruit its scarlet berries make it a conspicuous object. A cold infusion of the leaves is mucilaginous, and is used in irritation of the bladder and urethra. The oil of the seeds, *Pisa-taila,* is used as an application to sprains and itch.

Description.—Leaves 4 to 6 inches, penninerved, coriaceous, oblong-lanceolate or oblanceolate, rarely obovoid acute or acuminate, glaucous beneath, greenish above with impressed nerves, petiole ⅓ to ½ inch. Berries apiculate, scarlet, about the size and shape of a small acorn, pulp yellow, seed brown, polished, oblong, testa thin, brittle; kernel oily, white, the cut surface turning red on exposure to the air; taste aromatic, pungent like cubebs; the expressed oil solidifies into a white solid fat; as prepared by the natives it has a reddish colour, due to admixture of resinous matter. The bark and leaves are mucilaginous and not aromatic.

Chemical composition.—The dried and powdered red fruits of this tree yielded to ether 31·6 per cent. of extract consisting mainly of crystalline fats. Petroleum ether separated this extract into a soluble fatty portion, and an insoluble neutral reddish resin. The petroleum ether solution left on evaporation some fatty acids melting at 39° and solidifying at 35°, but which, on crystillization from boiling alcohol and pressure between filtering paper, afforded some purely white crystals melting at 42·5. The fatty acids would appear to consist of lauric acid with a small admixture of oleic acid.

The resin in the fruits was associated with a volatile oil to which the fragrance is due. The alkaloid detected in the spirituous and the watery extracts of the drug had the reactions of *laurotetanine.* The dried fruits left after ignition 4·77 per cent. of mineral matter.

LAURUS NOBILIS, *Linn.*

Fig.—*Bentl. and Trim., t.* 221. Laurel Bay (*Eng.*), Laurier (*Fr.*).

Hab.—Southern Europe. The berries.

Vernacular.—Hab-el-ghár (*Ind. Bazars*).

History, Uses, &c.—Bay berries were introduced into India by the Mahometans, and are still kept by their druggists in all the larger towns. The Bay or Noble laurel is the Daphne (δαφνη) of Dioscorides, which he describes as hot, demulcent, astringent and stomachic, and recommends the berries in φθίσις and chest affections, and as a stimulant adjunct to wine and ointments. This shrub was held in great esteem by the ancients, who relate that the nymph Daphne, when pursued by Apollo, and on the point of being overtaken by the god, prayed for aid, and was changed into a Bay tree. Prof. Max Müller compares this Greek myth to the Vedic myth of Urvási and Pururavas. The Bay was also used in conjuration; the young girl, who had been forsaken in the second idyl of Theocritus, says:—

Δέλφις ἔμ' ἀνίασεν. ἐγω δ' ἐπὶ Δέλφιδι δάφναν
Αἴθω. χ' ὡς αὐτὰ λακεῖ μέγα, καππυρίσασα,
Κἠξαπίνας ἅφθη, κοὐδὲ σποδὸν εἴδομες αὐτᾶς,
Οὕτω τοι καὶ Δέλφις ἐνὶ φλογὶ σάρκ' ἀμαθύνοι.

The priestesses of Apollo consulted the tree and ate of its leaves before delivering the oracles at Delphi. Hesiod tells us that the muses held branches of it in their hands, and poets are still nominally crowned with a laurel wreath. It was also an emblem of victory, and was used by the Romans in many of their ceremonies.

Oil of Bay berries, the δαφνέλαιον of Dioscorides, is still used in Southern Europe as a nervine stimulant. A medicinal oil is also prepared with the leaves and olive oil, which is much used in the south of France. The leaves are also considered to be febrifuge, and are used in all European countries for flavouring pastry. In America the dry leaves are largely distilled for the essential oil, which is used for the preparation of Bay Rum, a favorite hair-wash, the disinfectant action of which is due to the eugenol contained in Bay oil. Bayberry oil or expressed laurel oil is obtained from both the fresh and dried berries. The fresh berries are bruised, boiled in water, and pressed in a sack. The expressed oil is then mixed with the decoction, and when cold the oil is found floating on the surface. Dried berries are first exposed to steam, and then subjected to pressure between heated metallic plates. The oil has a butyraceous consistence, and granular appearance. Its colour is greenish, taste bitter and aromatic, with an odour like that of the berries. It melts at 86°—95° F. It is wholly soluble in ether, but alcohol only dissolves green colouring matter and the volatile oil. The solubility in ether affords a test of its purity; if admixed with lard, the ethereal solution is turbid and milky. (*Brannt.*)

Description.—Bay berries are oval or subglobular drupes about ⅜ to ½ an inch long. When dry, they are greenish-black or blackish-brown, slightly wrinkled, and fragile, the integuments, including the reddish-brown endocarp, being thin and brittle. The loose oval seed is easily separated into the two plano-convex brownish cotyledons, which have an aromatic, oily, and bitter taste.

Chemical composition.—The leaves and fruit contain a volatile oil. The volatile oil of Bay berries is pale yellow, sp. gr. 0·91, it congeals at a low temperature, contains oxygen, and is easily soluble in alcohol; it contains hydrocarbons, $C^{10}H^{16}$, boiling at 171° C. and 250° C., and four oxygenated constituents (Staub). Gladstone (1863) had found eugenol, while Blas (1865) could not detect this, but proved the presence of a little lauric acid. Bley (1834) obtained from old berries ·22 per cent. of volatile oil. The seeds contain, according to Bonastre (1824), about 20 per cent.

of fat, 2 per cent. of volatile oil, and 1·5 per cent. of resin. The expressed fat was analysed by A. Staub (1879), who determined, besides volatile oil and chlorophyll, the presence of a little acetic acid and the glycerides of oleic, linoleic, lauric, myristic, palmitic, and stearic acids. *Lauric acid*, $C^{12}H^{24}O^2$, discovered by Marsson (1842), has been found in many vegetable and a few animal fats; it melts at 43·5° C., and volatilizes with the vapours of boiling water (Goergey, 1848). Schmidt and Roemer found little free acid in the freshly-expressed oil, but the fruit contained 2 to 3 per cent. of fatty acids. (*National Disp.*)

Cassytha filiformis, *Linn., Rheede, Hort. Mal. vii., t.* 44; A'kásvel (*Mar.*), Amarbeli (*Hind.*), A'kásavalli (*Sans.*), is a common parasite on bushes; it consists of a tangled mass of tough dark-green stems, branched, marked longitudinally with delicate pale green lines, the largest are the size of a crow-quill; the branches are provided with small round suckers, like those of the common dodder. Sections of the stem show a strong fibro-vascular layer and loose central pith. The fruit is globular, of the size of a pea, and surmounted by the remains of the sepals; on removing the outer envelope, which is tough, an inner envelope is exposed, which consists of two layers, the outer cartilaginous, the inner fleshy and lined with white hairs, each containing a delicate spiral filament; within this central cavity is a third delicate membranous envelope covered with hairs, of a similar description, and containing the ovule. The whole plant is used in native practice as an alterative in bilious affections and for piles. In Southern Africa it is said to be used for washing the head, destroying vermin, and making the hair grow. In Senegambia it is employed in urethritis, and in Cochin-China as an antisyphilitic.

Chemical composition.—M. Greshoff has detected an alkaloid in this plant, having the following colour reactions: sulphuric acid faint red, Erdmann's reagent (sulphuric acid mixed with a little nitric acid) blue, nitric acid red-brown, Fröhde's reagent dirty blue. Dr. Greshoff believes that on a closer investigation of this alkaloid, it will be found to be identical with laurotetanine described under *Litsæa sebifera.*

THYMELÆACEÆ.

AQUILARIA AGALLOCHA, *Roxb.*

Fig.—*Roxb. & Coleb. in Trans. Linn. Soc. xxi., t.* 21; *Royle Ill., t.* 36, *f.* 1.

Hab.—Eastern Himalaya, Bhotan, Assam, Khasia Mts., Silhet and Tippera Hills, Martaban Hills.

AQUILARIA MALACCENSIS, *Lamk.*

Fig.—*Lamk. Ill., t.* 356; *Cav. Diss. vii., t.* 224; *Rumph. Amb. ii., t.* 10.

Hab.—Malacca, Malay Islands. Eagle or Aloe wood (*Eng.*), Bois de Calambac (*Fr.*).

Vernacular.—Agar, Agaru (*Indian Bazars*).

History, Uses, &c.—The use of this precious wood as a perfume and medicine is of great antiquity. Together with myrrh, cassia, and other products of the East, it is mentioned in the sacred writings of the Jews (*Num.* 24, 6; *Psalm.* 45, 8; *Prov.* 7, 17; *Cantic.* 4, 14) under the name of Ahalot or Ahalim. It is the αγάλλοχον of the ancient Greeks, which is described by Dioscorides as a wood brought from India and Arabia. Later writers, from Aëtius' time, call it ξυλάλοη or "aloe wood," the name by which it is still known in Europe. The same substance is the Agaru of the Hindus, the Garu of the Malays, and the Chin-heang of the Chinese. In Sanskrit medical works it bears the synonyms of Rájárha "worthy of a prince," Visvarupa "taking all forms," Krimi-ja "produced by worms," Krimi-jagdha, Anarya-ja "produced in a non-Aryan country," Kanaka "golden," Káliya "black," &c., and is described as hot, light, and cholagogue; removing diseases of the ear, nose and eyes. In native practice Agar is used as a deobstruent, stimulant, carminative, and tonic; it is said to relieve the pain in gout, and to check vomiting. Susruta directs Aguru, Guggula,* Sarjarasa, † Vacha, ‡ white mustard, Nim leaves and salt to be made into a paste with ghí to form an anodyne fumigation for surgical wounds, called in Sanskrit *Vedanárakshoghnair-dhupaih.* As aloe wood bears the Sanskrit name of Anarya-ja, it is probable that it was used by the aborigines of Eastern Asia before it became known to the Hindus, but that at a very early date it was carried overland to Central Asia and Persia, and from thence reached Arabia and Europe.

The early Arab travellers appear to have collected a good deal of information concerning the commerce and sources of supply of the wood.

Yohanna-bin-Serapion mentions four kinds, *Hindi, Mandali, Sinfi* and *Kamári,* and Ibn Sina in the 10th century has the following account of it:—"The best is called *Mandali* from the more central parts of India; next is the Indian or Hill aloe wood, which has the advantage over Mandali of preserving clothes from lice. Some say that Mandali and Indian aloe wood are the same. One of the best kinds is *Samandúri* from Sofala in India; again there is the *Kamári* and the *Samfi* from the same parts, and there is *Kákuli,* and *Kismári* which is moist and sweet; and the worst kinds are *Halái, Kamtái, Mabatái, Lawathi,* or *Rabatáthi.* Mandali is the best; then Samandúri, of a grey colour, fat and oily, heavy, without any white streaks, and which burns slowly. Some consider black aloe wood better than grey, and the best black is the Kamári, without white streaks, fat and oily, which burns slowly. In short, the best aloe wood is black, hard, and heavy, sinks in water, is not fibrous when powdered; that which does not sink is bad. The tree is said to be buried to promote the formation of aloe wood." The Arabian travellers give much the same names to different kinds of the wood. Ibn Batuta speaks of Kamári as soft, like wax. Abu Zaid calls it Kamarúni, and says it is the best kind. Abulfeda states that it comes from the Kamarún Mountains. Kákuli is said to derive its name from Kákaleh in Java. The epithets Máwardi, Saimuri and Jáwi are also applied by some writers to aloe wood. As regards the identification of these localities, we would remark that *Samfi* is probably derived from Champa, a province in Cambodia; *Mandali*, from Mount Mandar or Mandal, south of the modern town of Bhagalpur in Bengal; Kámari or Kamaruni, from Kamarun, the Arab name for Cape Comorin; Saimúri, from Saimur or Samar, an island in the Eastern Archipelago; Halái may possibly be derived from the Hala Mountains between Sind and Beluchistan, as Abu Zaid says that the best aloe wood is brought for sale by Multanis.

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* Resin of Boswellia serrata.

† Resin of Shorea robusta.

‡ Acorus Calamus.

Haji Zein-el-Attár (1368) calls aloe wood Ood-el-júj, and in Persian, Ood and Balanjúj. After translating Ibn Sina's article on Ood, he gives his own opinion in the following terms: "The author of this work (*Ikhtiarat-i-badiaa*) says the best is called *Kalambak* (کلمبک), and comes from the port of Jena, which is ten days' sail from Java; it is sold for its weight in gold; you would think it odourless, but when warmed in the hand it has a very sweet persistent odour; when burnt, the odour is uniformly sweet until the wood is consumed. Next is *Mandali* and *Samandúri*, both from Sofala in India, the best of these is of a golden colour and heavy. *Kákuli* is like the Indian, and is generally in large pieces, marked with black and yellow lines; then there is *Kamári*, golden-brown, without white streaks, it comes from Kamarún and Sofala; then *Samfi*, from Samp, it is very hard and sweet; then *Sakáli* and *Afasi*, a moist kind from China; then *Mantai*, *Randi*, *Halai*, and *Lanfi*, all of about equal value. And in Manta there is a tribe who call the wood *Ashbáh*, and it is of two kinds: one of these is in large pieces weighing from 5 to 50 maunds, without much odour, and used for making combs, knife handles, &c.

Mir Muhammad Husain (1770) writes:—" Ood, in Hindi Agar, is the wood of a tree which grows in the Jaintiya hills near Sylhet, a dependency of the Súbah of Bengal, situated towards the north-east of Bengal Proper. The tree is also found in the islands to the south of Bengal, situated north of the Equator, and in the Chatian islands belonging to the town of Nawaka, near the boundaries of China. The tree is very large, the stem and branches generally crooked, the wood soft. From the wood are manufactured walking sticks, cups, and other vessels; it is liable to decay, and the diseased part then becomes infiltrated with an odoriferous secretion. In order to expedite this change it is often buried in wet ground. Parts which have undergone the change above mentioned become oily, heavy, and black. They are cut out and tested by being thrown into water; those which sink are called *Gharki*, those which partly sink *Nim Gharki*, or *Samáleh-i-aala*, and those which float *Samáleh;* the last kind is much the most common. Gharki is of a black colour, and the other qualities dark and light-brown."

The best kind for medicinal use is Gharki Ood from Sylhet; it should be bitter, odoriferous, oily and a little astringent; other kinds are considered inferior. In most receipts raw Ood (Ood-i-khám) is enjoined to be used to prevent the use of wood from which the oil has been abstracted by crushing and maceration in water, or by crushing and admixture with almonds, which are afterwards expressed.* This precaution is the more necessary as Ood shavings are an article of commerce in India under the name of *Chúra agar;* they are often adulterated with chips of Sandalwood, or Taggar, an odoriferous wood, common in India.

Rumphius describes two kinds of true, and two of false, aloe wood; the first kind of true aloe wood, he says, is called Kilam or Ho-Kilam by the Chinese, and Calambac by the Malays, and is produced by a tree growing in the provinces of Champa and Coinam, and in Cochin-China. This tree has been described by Loureiro under the name of *Aloexylon Agallochum.* The second kind, called *Garo,* is the product of *Aquilaria malaccensis,* Lamk., which he figures. This is the Chin-heang of the *Pun-tsaou-kang-muh* or great Chinese Herbal. (See *Hanbury Science Papers*, p. 263.) His two kinds of false aloe wood he attributes to *Michelia Champaca* and *Excœcaria Agallocha.*

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* Nicolaus Myrepsicus prescribes *Agallochum crudum.*

Roxburgh and other botanists have examined the Aquilaria in Sylhet, and recently an *Aquilaria* has been ascertained to be the tree which produces aloe wood in the islands of the Mergui Archipelago. Gamble says that "*Akyau* (the Burmese name for aloe wood) is the most important produce of the forests of South Tenasserim and the Mergui Archipelago. It is found in fragments of various shapes and sizes in the centre of the tree, and usually, if not always, where some former injury has been received."

Aloe wood is used throughout the East as an incense and as a perfume, and was formerly used as a medicine in Europe for the same diseases for which it is still prescribed in India.

Collection.—In Sylhet, the collection of aloe wood is a precarious and tedious business; those engaged in it proceed some days' journey into the hilly districts, where they fell any trees they may find, young or old, and then, on the spot, search them for the *Agar*, as the valued wood is called. This is done by chopping off the bark, and into the wood, until they observe dark coloured veins, indicating the proximity of wood of valuable quality, which generally extends but a short distance from the centre of a trunk or branch. In this manner a whole tree is searched through, the collectors carrying away only such pieces as are rich in odoriferous resinous matter. In some districts it is customary to facilitate the extraction of the resinous wood by burying portions of the tree in moist ground, or by allowing the entire tree to remain a length of time after it is cut down, the effect of which is to cause decay in the non-resinous wood, and thus render it easily removable by an iron instrument. Aloe wood is sorted by the collectors into various qualities, the finest of which, called *Gharki,* is worth in Sylhet from 6 to 8 rupees per pound. (*Hanbury Science Papers.*)

Description.—The wood occurs in irregular pieces, which vary in colour from grey to dark-brown, according to the amount of resin which they contain; both light-coloured and dark pieces are marked with longitudinal veins of a darker colour. The best pieces show numerous cavities and sinuses produced by the cutting away of wood less impregnated with resin; they sink in water. When a portion is chewed, it softens between the teeth; the taste is bitter and aromatic; when burnt, it diffuses an agreeable odour.

Mr. J. G. Prebble has kindly furnished us with the following interesting remarks upon the aloe woods of the Bombay market:—"The true Agar woods are imported into Bombay, in boxes holding about 1½ cwt., from Bankok, and usually *viâ* Singapore or Batavia. Some of the Parsee dealers in Chinese silks also import Agar from Hongkong, in small rectangular parcels holding about 1 lb. each, and bearing a yellow label with the name of the packer in the Chinese character. This Agar which I have examined is the Gaguli variety (*A. Agallocha*), and has been carefully dressed, and polished or painted black. One or more false Agars composed of heavy resinous woods are also imported from Singapore. The true Agars vary considerably in the amount of resin they contain; old and decayed samples consist largely of resin. A good specimen yielded to Hanbury* 48 per cent. of matter soluble in rectified spirit. Compact and not apparently very resinous samples of Gaguli and Mawardi Agar, treated successively with petroleum ether, ether, and alcohol, gave:—

	V olatileoil.	Resin soluble in ether.	Resin soluble in alcohol, insoluble in ether.
Gaguli	½ per cent.	13·8 per cent.	9·4 per cent.
Mawardi	1·5 per cent.	11·6 per cent	9·0 per cent.

The volatile oil is of a yellow colour, and possesses the characteristic odour of the woods. It gives a reddish-brown coloration with sulphuric acid. The ether resin is soluble in aqueous solution of potash, with a reddish-brown colour, from which the resin is precipitated by acids. The two true Agars Gaguli and Mawardi are composed of rather thin-walled wood-cells, traversed with numerous one-celled rows of medullary rays which are frequently interrupted by large cellular passages or medullary spots. These structures appear as elongated spots of cellular tissue with their greatest diameter following the periphery of the stem.* In Mawardi Agar the vessels are much larger and more numerous than in Gaguli Agar. The vessels, rays and cellular passages are filled with resin. On comparing sections of the stems, ⅛ inch thick, of herbarium specimens, kindly sent by Dr. King from the Calcutta Herbarium, of *Aquilaria Agallocha* and *A. malaccensis* with the Agars, it was observed that the structure of Gaguli Agar was apparently identical with that of *A. Agallocha*, and I think there is little doubt that this tree is the source of this variety of Agar. Mawardi Agar is also probably derived from *A. malaccensis*. The false Agars have thick-walled wood-cells, less numerous vessels than in the true Agars, and no well-defined medullary spots.

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* *Science Papers*, page 265.

" **Taggar wood** is a heavy, dark-coloured, oily and resinous wood, the botanical origin of which is unknown, imported into Bombay from Zanzibar. It sinks in water, and its aqueous infusion has a yellow colour with a greenish fluorescence From Bombay it is sent to the large cities of Northern India, Delhi, Lucknow, &c., where it is distilled with other ingredients to form some of the compound attars, so much esteemed by the natives.

According to Dr. Royle's Catalogue, Taggar wood was sent from Delhi to the great Exhibition of 1851. Twenty pounds of the ground wood submitted to distillation with water during three consecutive days, with frequent cohobation, yielded six fluid ounces, equivalent to two per cent. of a yellowish oil which quickly changed to a reddish-brown colour. The oil is neutral, of sp. gr. ·9546, bitter, and with an odour resembling, but distinct from sandal wood oil. It dissolves in all proportions of alcohol, ether, chloroform, benzol and petroleum ether. It dissolves iodine without violent reaction, and yields no characteristic reaction with sulphuric acid, being only darkened in colour. Exposed to the air in a thin layer, it acquires a crimson colour. At a low temperature, by keeping in ice, the oil remains clear and free from any deposit, but becomes very thick and viscid, and develops a strong greenish fluorescence which vanishes or nearly so at a higher temperature, 85° F. The finely powdered wood, treated successively with petroleum ether, ether, and alcohol, yielded to the petroleum ether 8·75 per cent. of a mixture of volatile oil and resin, which deposited on the sides of the evaporating dish a few small tabular crystals. On drying at 110 C., this mixture of oil and resin lost volatile oil equivalent to 5·75 per cent. The ether extracted a resin, 6·4 per cent., soluble in aqueous solution of potash, with a deep reddish-brown colour and greenish fluorescence, in solutions of ammonia and of carbonate of soda. The resin is precipitated from these solutions by acids. Strong sulphuric acid dissolves the resin with a red colour, from which it is precipitated by water in yellowish-brown flocks. It is readily soluble in glacial acetic acid, but no crystals were obtained on the spontaneous evaporation. It is insoluble in benzol and petroleum ether and in boiling alum solution. The resin probably contains an anthraquinone derivative allied to Emodin and Chrysophanic Acid, but I have not yet succeeded in isolating it. Alcohol extracts a resin, 4·12 per cent., insoluble in ether. Taggar wood is valued in Bombay at about Rs. 3 per maund of 28 lbs."

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* De Bary, *Comparative Anatomy of the Phanerogams and Ferns*, page 492.

Mazariyun.—The Mezereon of Mahometan physicians is described in their works upon Materia Medica as a leaf.

It is considered by C. Bauhin to be the *Oneorum tricoccon*, and is probably the same as the *Chamælea* of Scribonius, of which he says: "Purgat belle chamælea, quæ herba olivæ folia similia habet: quorum quinque vel sex dare oportet." (*Comp.* 136.)

Apuleius Platonicus has the following notice of it:—"Alii pyros agnen, alii heracleon, alii bdelyram, alii coccon gnidion, Romani citocacium, nonnulli oleaginem, quidam oleastellum vocant." (*De Vir. Herb.*, 26.)

Mír Muhammad Husain says there are three kinds, *viz.*, white with large thin leaves, called *Ashkhís*, yellow with yellowish thick leaves, smaller than those of the olive, called in Persian *Haft-barg* and *Musht-rú*, and black with black leaves! The white is to be preferred as the least acrid; but even the leaves of this kind require to be soaked for forty-eight hours in vinegar, which should be several times changed, to make them fit for medicinal use. Having been thus prepared, they are to be washed and dried, and pounded with almond oil. This preparation may then be given in combination with purgatives, bitters and aromatics, in dropsy or in such cases as are benefited by hydrogogue and drastic cathartics, to the extent of 24 grains. Mulla Ahmad Nabtí, in his *Tarikh-el-hukama*, tells a story of a dropsical patient, who was cured by eating locusts which had been feeding upon Mezereon leaves; they acted as a hydrogogue cathartic.

Lasiosiphon eriocephalus, *Dcne.*, *Wight Ic.*, *tt.* 1859-60; *Jacq. Voy. Bot.*, *t.* 150, a native of the Deccan Peninsula and Ceylon, is a shrub with leaves like the willow, and terminal heads of flowers, surrounded by an involucre of oblong, rather hoary leaflets. It is common on the hills of Western India, and the bark is a powerful vesicant, which has not, as far as we are aware, been mentioned in native medical works. The peasantry are, however, acquainted with its properties, and when they have a lean ox or cow to take to market, rub the skin with a decoction of the bark, which causes swelling and an appearance of plumpness, which disappears in a few days much to the discomfiture of the purchaser.

Dr. J. Y. Smith, in his *Matheran Hill, its People, Plants and Animals* (p. 35), says "the *Rametha* bushes are often seen stripped of their bark, which is used for poisoning fish."

The bark consists of an outer suberous portion which is of a light-brown colour and divided by numerous transverse and longitudinal fissures, so that it can be easily separated, and of an inner layer which is white, tough, and silky like Mezereon. The wood-cells are easily separated and form pretty microscopic objects, as they are beautifully transparent. The taste is acrid.

Chemical composition.—The fresh bark was beaten into a paste in a mortar, and the mass divided and placed in two bottles, one containing ether and the other spirit of wine; they were both shaken occasionally and the mixture allowed to macerate for 24 hours. The ether extract was filtered off and evaporated at a very low temperature until a thick, green, greasy substance was left. This was washed with warm water and a small piece placed upon the skin of the arm and spread so as to cover a space the size of a rupee. In about two hours irritation of the skin was produced, and, on removing the covering of the arm, it was found that several small blisters had formed under the extract and extending beyond it. The alcoholic tincture was then removed by filteration and carefully evaporated at a gentle heat. The residue contained very little of the green-coloured resinous matter, but a large quantity of saccharine substance, which was non-crystalline. This extract was applied to the skin as in the previous experiment, but the application was followed by only a slight reddening due to the small amount of resin in the dried extract. The resin appears to be the source of the vesicating principle of the bark. It has an acid reaction in neutral solvents, is soluble in ammonia with a yellowish-brown colour, and is associated in the ethereal extract with a fatty base which facilitates its use as a blistering agent.

The roots of **Daphne oleoides**, *Schreb.*, *Royle Ill.*, *t.* 81, are used in Afghanistan as a purgative. Aitchison (*Flora of Kuram Valley*) says: "Camels will not eat this shrub except when very hungry. It is poisonous, producing violent diarrhœa. I feel certain that much of the mortality of camels in the Kuram Division was due to the prevalence of this shrub."

LORANTHACEÆ.

VISCUM ALBUM, *Linn.*

Fig.—*Eng. Bot. xxi., t.* 1470; *Woodv. Med. Bot.*, suppl., *t.* 270. White Mistletoe (*Eng.*), Gui (*Fr.*).

Hab.—Temperate Himalaya. Westward to the Atlantic. The berries.

Vernacular.—Kismish-kawali (*Ind. Bazars*).

History, Uses, &c.—Mistletoe is the ἰξος of Theophrastus and Dioscorides, and was considered by the ancients to have discutient properties. It was applied to disperse tumors and to mature abscesses, and was given internally in enlargement of the spleen. Matthiolus and Paracelsus recommend it in epilepsy, and Kölderer, Cartheusar, Colbatch, Löseke, Van Swieten and others have stated that they found it beneficial not only in this disease, but in other convulsive affections. This plant was formerly held to be sacred in Europe, and in ancient Britain it was cut with a golden sickle by a Druid in white robes, amid the sacrifice of victims and the fasting of devotees. Thus obtained, the *Gwid* was considered a heal-all, a charm against disasters, and the emblem of fertility. As such it was a special object of worship with the ancient Britons, who called it *uchelfa*, a high place, *uchellawr*, the most exalted, *uchelwydd*, the lofty shrub, *awyrbren*, the ethereal tree, *prenpuraur*, the tree of pure gold, &c.—names still surviving in the Welsh language.

Pliny (xvi., 93, 94, 95) describes the Viscum, and the method of making birdlime from it; he also notices the superstitions held concerning it by the Gauls, and its worship on the fifth day of the moon, the day which is the beginning of their months and years. A festival in honour of the mistletoe called *Guilanleu* or *Guilanneuf* (gui de l'an neuf) was held in France as late as the 16th century, and in England the plant still hangs in the hall at Christmas.

The dried berries sold in the bazars as *Kismish-kawali*, or more correctly *Kismish-i-káwaliyán*, are also called Muizak-i-asli, and in Arabic, Dibk.

Káwali or Kauli is the name of a gipsy tribe in Persia. Baron C. A. de Bode, in his *Travels in Luristan and Arabistan* (Vol. II., p. 100), mentions his being shown in the forests of the Zagros mountains, on the road from Kirmanshah to Baghdad, a fruit called by the natives Angur-i-Kauli, or grapes of the Kauli, which grow on the Mázu or gall-tree (oak), of a yellowish transparent colour, sometimes used as glue.

The hakím Dáwúd says of Dibk (in a passage which is imperfect in the *Táj el Arús*) "it is found upon the tree in like manner as lichen (الشيبة), but is a berry, like the chickpea (حمص) in roundness; . . . . the best thereof is the smooth, soft, with much moisture, inclining, in its exterior, to greenness, and it is mostly found upon the oak; when it is cooked with honey and دبس (juice of fresh dates, &c.) . . . . and drawn out into longish strings, and put upon trees, the birds become caught by it." (*Madd el Kámús.*) The author of the *Makhzan-el-Adwiya* has the following account of it:—"A berry smaller than the seed of *Cicer arietinum*, green when fresh, but when dry shrivelled and of a brown colour, the contents are moist and viscid, the seeds about the size of poppy-seeds. The plant is parasitic upon the pear and other trees, and consists of several branches, the leaves are like those of the pomegranate, and of a pale green. Properties resolvent and laxative, a solvent of corrupt humors which it withdraws from the system. When steeped in hot water, strained, and beaten up with the kernels of the walnut or castor oil (which is the usual form of administration), it clears the system of adust bile and phlegm, removes obstructions, and is a remedy for lumbago, piles, &c. Applied externally it promotes the suppuration, or causes the dispersion of tumors or enlargements. Sportsmen use it as birdlime, and dyers as a mordant for crimson."

Of recent years, mistleloe has again attracted attention as a medicine. Dr. W. H. Long (*New Remedies*, 1878, p. 112) after, ten years' experience of it as an oxytocic, arrived at the conclusion that it is superior to ergot. He used it also in the forms of infusion, tincture, decoction and fluid extract in many cases of menorrhagia and post-partum hæmorrhage with gratifying results. He conceived that it incited the natural, rather than the tonic, contraction of the uterus. A physician in South Carolina refers to three cases of abortion in negroes produced by this plant. (*Med. Rec.*, xvii., 276; *Stillé and Maisch.*, *Nat. Disp.*, 1884, p. 1617.) Dr. R. Park speaks of a tincture of *Viscum album* as a valuable substitute for Digitalis; the ecbolic action of the plant, he says, is more energetic than that of ergot. Dose, 10—60 grains.

Description.—The dried berries are about ⅓ of an inch in diameter, soft, brown, and shrivelled; they contain a small seed about the size of a poppy-seed. When crushed they are very sticky.

Chemical composition.—M. Pavlevsky (*Bull. Soc. Chim.* (2), xxxiv., 348) has obtained from the leaves of *V. album* a crystallizable acid corresponding to the formula CH^4O^4 or $(CH^3O^3)\,HO$. It forms large prisms insoluble in alcohol and ether, slightly soluble in water, and fusing at 101—103°C. It is obtained by boiling the leaves with water acidulated with nitric acid, and allowing the decoction to cool. The silver salt of this acid is explosive. (*Year-Book of Pharm.*, 1881, p. 63.)

The berries contain a substance which has been named *Viscin* by Reinsch, who obtained it from birdlime by digesting it with 90 per cent. alcohol as long as it coloured that liquid yellow, after which it was boiled repeatedly with alcohol to remove wax. The remaining yellowish-brown mass, when treated five or six times with ether, gave up viscin, whilst *viscaoutchin* and woody fibre remained undissolved. The ethereal solution was then evaporated, and the viscid yellow mass thus obtained kneaded with alcohol so long as it gave off colouring matter. It was then kneaded under water, and heated to 120°, without access of air, until the whole of the water was expelled. Viscin is a clear transparent mass, of the consistence of honey at ordinary temperatures, and capable of being drawn out into long threads; fluid at 100°, like oil of almonds; sp. gr. 1. It produces a greasy stain on paper, is nearly inodorous and tasteless, and has an acid reaction. Formula $C^{40}H^{48}O^{16}$. Viscaoutchin remains behind, together with woody fibre, after the extraction of viscin by ether as above, and is taken up by oil of turpentine. After distilling off the turpentine, the yellowish mass is dissolved in ether, in which it has now become soluble; the ethereal solution is evaporated, and the residue is washed with alcohol and water, and dried at 120°. At ordinary temperatures it is viscid, and resembles vegetable wax; at 120° it is of the consistence of olive oil. It is very elastic, and may be drawn out into long threads; sp. gr. 0·978. It is tasteless, of faint odour and neutral reaction. Formula $C^{40}H^{37}O^{5}$. (*Gmelin*, xvii., p. 352.)

Viscum et **Loranthus**, sp. var. In the *Pharmacopœia of India*, the leaves of a Viscum, doubtfully referred to *V. monoicum* (Kuchila ke molung), growing on Nux Vomica trees in the neighbourhood of Cuttack, are stated to possess poisonous properties similar to those of the tree on which the plant grows. The subject was investigated in 1837 by Sir W. O'Shaughnessy, who is said to have detected in the powdered leaves the presence of strychnine and brucine: and the leaves were for a time used by Dr. Duncan Stewart and others as a substitute for Nux Vomica. A case of what is stated to have been fatal poisoning by the leaves is mentioned by Norman Chevers in his work on *Indian Medical Jurisprudence.* The symptoms were those of strychnia poisoning. In 1861 Mr. Leon Souberain (*Pharm. Journ.*, p. 568) published an account of a poisonous species of Loranthus found on the Nilgiris, growing on Nux Vomica trees, and known to the natives as *Poulourivi.*

In Pudukota, a decoction of a species of Loranthus called *Pillooroovi* or *Kooroonthoo,* probably the same plant, is applied to skin diseases to relieve itching.

Under the name of *Bandákpushp,* the flowers of *Loranthus longiflorus,* Desrouss., *Rheede, Hort. Mal., x., t.* 4, have been sent to us from Poona as having a reputation among the Hindus as a remedy in consumption, asthma, and mania; they are astringent.

Dr. Buchanan-Hamilton, when in Mysore, was shown the *Loranthus falcatus*, Linn. ('Wotu,' *Canarese*), the bark of which was used by the poorer natives in place of betel-nut; with quicklime it tinges the saliva and mouth of a fine red, brighter even than that communicated by the Areca.

In Travancore, the Loranthaceous parasites on the Nux Vomica are called *Kanjiram-eitthal* in Malayalim, and are used in medicine by the natives, but when the parasites are scarce, the young leaves of the Nux Vomica tree are used as a substitute.

A contribution by M. A. Chatin to the Paris Academy of Sciences entirely contradicts the statement we have extracted from the *Pharmacopœia of India*, and the belief of the natives that these parasites partake of the nature of the plants upon which they grow; so that the old ideas concerning the non-elaboration of sap by parasitic plants will have to be abandoned.

M. Chatin finds that the tannin of the mistletoe is not identical with that of the oak on which it grows, but gives a green colour and not a blue-black with iron salts; that the *Loranthus*, which grows on *Strychnos Nux Vomica*, does not, as has been asserted, contain a trace of either strychnine or brucine, and that the *Balanophora* parasitic on *Cinchona Calisaya* does not contain any of the alkaloids of cinchona barks. The *Loranthus* growing on orange trees never partakes of the yellow colour of the wood of its host plant, nor does the *Orobanche* of the hemp possess the odour of the latter; while *Hydnora africana*, used as food in South Africa by the Hottentots, grows on an acrid and even vesicating *Euphorbia*. It is evident, therefore, that the sap absorbed from the host plant must be modified by the parasite to form its own peculiar products. (*Pharm. Journ.*, May 2nd, 1891.)

The Forest Officer of Ganjam, a district where the Strychnos grows so plentifully, sent to one of us a specimen of a species of Viscum taken from these trees, which was identified as

V. articulatum. The sample was a small one, but it was sufficient to determine by analysis that the trace of alkaloid present was neither strychnine nor brucine. The leaves contained a peculiar tannic acid, giving a green precipitate with ferric salts, and a resin soluble in ether and alcohol, striking a blood-red colour with strong sulphuric acid. The chemical constituents of the leaves of the parasite were altogether different to those of the leaves of the Nux Vomica tree.

SANTALACEÆ.

SANTALUM ALBUM, *Linn.*

Fig.—*Bedd. Fl. Sylv., t.* 256; *Hayne, Arnz. Gewachs. x., t.* 1; *Bentl. and Trim., t.* 292; *Rumph. Amb. ii., t.* 11. Sandalwood (*Eng.*), Santal blanc (*Fr.*).

Hab.—Deccan Peninsula. The wood and essential oil.

Vernacular.—Chandan, Sufed-chandan (*Hind.*), Sandanakkattai (*Tam.*), Gandhapu-chekka (*Tel.*), Chandana-mutti (*Mal.*), Gandhada-chekke (*Can.*), Chandon, Sada-chandon (*Beng.*), Chandana, Sukhada (*Guz.*), Chandana, Gandha-che-khor (*Mar.*).

History, Uses, &c.—Sanskrit writers make two kinds of Chandana: the darker, heartwood, they call *Pitachandana*, or yellow Sandal; and the lighter wood, *Srikhanda*, or white Sandal. Chandana is mentioned in the *Nirukta*, or writings of Yaska, the oldest Vedic commentary extant, said to be written not later than the 5th century B.C. It is also referred to in the ancient epic poems of the Hindus, the *Ramayana* and *Mahabharata.*

According to the *Kathásaritságara*, it is one of the trees of the Buddhic paradise, and the chariot of the sun is made of its wood bound with gold.

Sanskrit medical writers describe sandalwood as bitter, cooling, astringent, and useful in bilious fever and heat of body;

a paste of the wood is directed to be applied externally to inflammatory affections of the skin, and is a domestic remedy for all kinds of pains and aches. Under the name of *gandh* (perfume), it is largely used in Hindu ceremonial, being smeared upon idols and upon the foreheads of their worshippers. The wood is chiefly consumed at the *chita* or funeral pile, even comparatively poor people spending as much as fifty rupees upon it. The Parsees also use it at their funeral ceremonies. Mahometan medical writers, commencing with Masih and Ibn Sina, call the wood Sandal, and follow the Hindus in distinguishing the dark-coloured portion from the light. The author of the *Makhzan* describes it as cold and dry, cardiacal, tonic, astringent, alexipharmic, antaphrodisiac, a resolvent of inflammatory swellings, &c. He recommends an emulsion in bilious fever, on account of its cooling and protective influence over the heart, brain, stomach, &c. As an external application a paste made with rosewater and camphor, or with sarcocolla and white of egg, may be applied to relieve headache, or to any kind of inflammatory swelling or skin affection. Sometimes the paste is made with the juices of herbs, such as purslane, nightshade, &c. Ainslie states that in Southern India sandalwood given with milk is regarded as a valuable remedy in gonorrhœa. Rumphius (ii., p. 42) mentions a similar use of it at Amboyna. In the Concan sandalwood oil with cardamoms and bamboo manna is given in gonorrhœa, and mixed with limejuice and camphor it is used as a cooling application to eruptions, &c. A conserve of sandalwood is also made by boiling the wood cut in small pieces in bangar-khár (impure carbonate of potash) and water (4 seers sandal, half a seer bangar-khár, and 32 seers water), until it is quite soft. It is then preserved in a thick syrup. Sandalwood was known to the Greeks from the time of Alexander. Arrian mentions ξύλα σαγαλίνα among the Indian imports into Oman in the Persian Gulf. Constantinus Africanus, a physician of the School of Salerno, appears to have been the first to use it medicinally in Europe. In the *Pharmacopœia of India*, Dr. Æ. Ross is stated to have subjected the wood to trial, and found that whilst its effects as a stimulant were very slight, its secondary effect was that of a sedative on the circulation. In remittent fevers in which it was administered, it acted as a diaphoretic, diminishing at the same time the rapidity rather than the violence of the heart's action. Dr. Henderson, of Glasgow, and, in France, Drs. Panas, Gubler and Simmonet, have directed the attention of European physicians to the valuable properties of the oil as remedy for gonorrhœa, in doses of from 30 to 40 minims three times a day, and there is now some demand for it in India for this purpose.

Dr. Henderson asserts that he always found it inoffensive, even in strong doses; that at the expiration of forty-eight hours complete relief is effected; besides, it has the important qualification of pleasing the patient and being agreeable to the stomach; it is superior to copaiba and cubebs, succeeding where the latter have failed, and with a delicate subject it is to be highly valued as a remedy uniting a real stomachic to a great specific action, and that, in short, during the last five years, he is indebted to it for a great number of successful cases. (*Medical Times and Gaz.*, June 1865.) In a communication to the Paris Chirurgical Society, Dr. Panas (1865) equally advocated its use. Oleum Santali has also been prescribed in chronic catarrh of the bladder, where it performs the same offices as oil of turpentine, without its injurious effect on the kidneys and alimentary canal. In all cases it is best administered in the form of Midy's Capsules, ten to twelve of which may be given daily at first, divided into three doses, each of which may be taken a quarter of an hour before meals; the number of capsules taken daily may be gradually increased to 24, but as soon as the discharge becomes serous, the dose should be gradually diminished. M. C. Méhu has observed that after the internal administration of oil of sandalwood, a resinous substance is found in the urine having the odour of the wood, which appears to be kept in solution by phosphate of soda, and which has the properties of a very weak acid. This resinous substance can only be obtained in very small quantities by shaking the urine with ether; to obtain it in larger quantity, an acid must be used (phosphoric or tartaric), which makes the urine turbid from separation of the resinous matter. If the urine is now shaken with ether, and the ether evaporated, the resinous matter is obtained of a light-brown colour, and having the odour of sandalwood. This substance in contact with concentrated sulphuric acid affords the same yellow-brown and red colours as pure oil of sandalwood. M. Méhu has also observed that the pure sandal oil does not communicate a violet odour to the urine, as is the case when the oil is adulterated with copaiba and turpentine. (*Journ. de Pharm. et de Chim.*, Sept. 1st, 1886.) The fact of a resin being precipitated by acids from the urine in cases in which sandalwood oil has been administered, has therefore to be remembered in testing for albumen with nitric acid.

Description.—Sandalwood logs are about a yard in length and 5 to 6 inches in diameter; they are stripped of the bark and a portion of the sapwood. Andreas Petersen of Copenhagen, who made in 1886 a very careful investigation of the wood, says:—"It is very homogeneous, rather hard and ponderous, although it does not sink in water. The heartwood is pale reddish, with darker reddish-brown and brighter yellowish concentric zones, which, when examined under the microscope, prove to be annual rings. In the inner part of the wood they are sometimes very wide, measuring, for instance, as much as seven millimetres. Possibly, therefore, they do not correspond to one year's growth, but to that of a longer period.

"The transverse section, examined by means of a lens, displays the numerous narrow medullary rays; the vessels are partly empty, partly loaded with yellow resin. In the bright yellowish sapwood both vessels and medullary rays are less distinct. The sapwood is scentless, whereas the heartwood, especially when freshly cut, is in a high degree possessed of the very agreeable and remarkably persistent odour of sandal oil.

"The miscroscope shows the prevailing part of the tissue of the wood to be made up of ligneous fibres (libriform), the thick walls of which are marked with small annular pits (behöfte Tüpfel). The woody tissue is traversed by medullary rays consisting of one or two rows of somewhat irregular cells. On a transverse section, the distance of the medullary rays from each other is very different. According to the size and position of the vessels, the medullary rays are somewhat undulated. Most of the vessels are very large, the largest as much as 89 mkm. in diameter. They are very regularly distributed, either isolated, or in groups of two or three, very seldom more. Their walls are very thick, being marked with numerous annular pits, communicating with those of the surrounding cells. There is also to be met with in the wood, parenchymatous tissue to some extent, which is made up either of isolated cells or of short tangential or oblique rays of two to five cells; these parenchymatous layers very seldom run from one medullary ray to another. Crystals of oxalate of calcium are also found; and in longitudinal sections they are seen to be enclosed in long ducts, containing each 10—15 crystals. As to the concentric zones of darker and brighter tint, as mentioned above, the vessels of the latter zones are much smaller and less numerous than those of the dark ones; the libriform cells likewise show the same difference, although less distinctly. Thus the dark zones in all probability represent the wood built up in spring. The vessels have an average diameter of 74 mkm., those of the vessels in the other rings being only 47 mkm.

"The darker colour is due partly to the actual cell-walls, partly to the resin contained in numerous vessels. On the whole, the concentric markings or zones are more distinct to the naked eye than under the microscope. On a vertical section the medullary rays are seen to be built up of usually less than eighteen layers, each consisting of two or three rows of cells. The position of the medullary rays and pits does not allow this wood to be classed among the woods which were described by Höhnel as showing the remarkably regular arrangement of layers or series like stories, which he termed a 'stockwerkähnliche' structure. If these slices of the wood are boiled for some minutes with nitric acid (1·185), a little chlorate of potassium being added, the single cells are easily isolated. The libriform cells are then distinctly seen to exhibit the typic form alluded to above, a few of them reminding one extremely of the fibres, of which the pinewood is made up. I have also noticed intermediate fibres, marked with both true annular and laterally extended pits (Hoftüpfel and Spalttüpfel). The vessels are short, somewhat obliquely truncated, and perforated with a great annular hole, the ends of the vessels being more or less pointed.

"Only the heartwood is valuable, the sapwood and branches being not used. I failed, in fact, in demonstrating the presence of oil in the sapwood, the tissue of which is nearly colourless, and exhibits no contents at all in its cells. In the heartwood, on the contrary, the cell-walls are very rich in yellow colouring matter. The parenchymatous part of the wood, the medullary rays and numerous vessels are loaded with a yellow-brownish resinous matter. Thin slices, examined under water or glycerine, display a great many smaller and larger drops, soluble in alcohol and reducing osmic acid (1 part dissolved in 100 parts of water); no doubt they are drops of essential oil. These drops, flowing out of the ducts, on thin sections are seen most abounding along the primary membranes of the cells and in their pits. But if rather thick sections are treated with osmic acid, the woody parenchyme and the medullary rays also assume a black colour, due to reduced osmium. If, on the contrary, the sections, before being treated with osmic acid, have been well washed with alcohol, the just mentioned parenchyme is not at all or but extremely faintly blackened. The cells under notice contain no tannic matter, as shown by means of bichromate of potassium and chloride of iron, the reduction of the osmic acid is consequently not due to tannic matter. Small pieces of the heartwood were further treated for some days with a solution of osmic acid, then extracted by means of alcohol and dried. When sections were made from these pieces, I ascertained that nearly all the parenchymatous parts had assumed a black colour. Sometimes also the libriform cells contain a small amount of oil, but the experiments just mentioned prove the *parenchymatous tissue of the wood to be the principal seat of the essential oil.* When treated with a mixture of equal parts of glycerine and solution of potash (5 per cent.), oil drops are also distinctly seen in the parenchyme. I ascertained that there is no corky membrane in the walls of these cells, like that occurring in many other cases. From a physiological point of view, the absence of corky walls of the cells of the heartwood might be expected." (*Pharm. Journ.* (3), xvi., 757.)

Chemical composition.—The wood treated with boiling alcohol yields about 7 per cent. of a blackish extract, from which a tannate is precipitated by alcoholic solution of acetate of lead. Decomposed by sulphuretted hydrogen, the tannate yields a tannic acid having but little colour, and striking a greenish hue with a ferric salt. The extract also contains a dark resin. (*Pharmacographia.*) The most interesting constituent of sandalwood is the fragrant essential oil. It is a yellowish, remarkably thick liquid, having a high specific gravity (usually more than 0·960); and is a mixture of hydrocarbons and oxygenated oils, boiling at a very high temperature. The specific gravity of a pure sample of oil distilled at Hunsur from the roots was 0·9745 at 15°·5. M. Chapoteaut (*Bull. Soc. Chim.*, xxxiv., 303) has shown that it is composed of two oils, one boiling at 300° and the other at 310°, and that the composition of the oil boiling at 300° is $C^{15}H^{24}O$, and of the oil boiling at 310° $C^{15}H^{26}O$. This chemist has been able to obtain with the latter oil a series of ethers under the influence of the different acids he brought to act upon it, and has announced the important fact that the oil $C^{15}H^{26}O$ is an alcohol, the aldehyde of which is the oil $C^{15}H^{24}O$. Phosphoric anhydride absorbs water from both, converting them into hydrocarbons of the formulæ $C^{15}H^{22}$ and $C^{15}H^{24}$, respectively. By the Indian process only 2·5 per cent. of oil is obtained from the wood, but the powerful apparatus of Messrs. Schimmel & Co. of Leipzig affords as much as 5 per cent.

Collection and Commerce.—Mr. C. E. M. Russell, Superintendent of Forests in Mysore, in a Report upon sandalwood (1889), says:—"Sandalwood is the most important source of Forest revenue in Mysore. It is a monopoly of the Mysore Government, and, except by Government Agency, no sandal tree can be uprooted or cut down even upon land which is private property. The only exceptions are the Jahgirdar of Yelandur and the Guru of the Sringeri Matt, who are permitted to cut and dispose of the sandalwood of their own Jahgirs. The tree is plentiful in the Mysore country, and occurs also, but in far less quantities, in those portions of the Madras territory which border upon Mysore; for practical purposes, however, Mysore may be said to almost hold the monopoly of the sandal supply. It is a somewhat delicate tree, is killed outright by fire, is very impatient of injuries to the roots and bark, and requires shade and protection while young. The value of the wood is dependent upon a volatile oil which is contained in the heartwood only, and in order that this oil may be developed in the highest possible degree, it is necessary that the growth of the tree should be slow, consequently sandalwood grown in arid situations on poor stony soil is, though small, of far more value than is that produced by large well-grown trees growing in moist situations and in richer soil. The maturation period of the sandal tree is variously stated at from 40 to 60 years. Sandalwood is not eaten by white ants, and its contained oil preserves it from decay in a remarkable degree, of which the present collection of old sandal roots left in the ground for many years past is a conclusive proof. In former times it was the custom not to uproot, but to fell, sandal trees, whereas for many years past the trees have been uprooted, and the roots, which contain a higher percentage of oil than the wood, are in great demand and command high prices.

"Even in periods of depression of the sandal market, a fair demand for roots has always been noticeable. The method of preparation is as follows:—

"The trees having been uprooted are roughly deprived of bark and of some of the sapwood on the spot, and are then carted into the nearest of the sandal Kothis, of which nine exist in the Mysore Province.

"The distribution of the various sandal Kothis and their names are:—

District.	Number of Kothis.	Names.
Mysore……………………	2	Hunsur and Seringapatam.
Bangalore……………………	1	Bangalore.
Shimoga ……………………	4	Shimoga, Tirthahalli, Anantapur, and Shikarpur.
Hassan……………………	1	Hassan.
Kadur ……………………	1	Chikmagalur.

"On arrival at the Kothis, the trunks are sawn off above the roots, cut into lengths, all the white wood removed, the billets adzed and subsequently planed and smoothed, the roots adzed and freed of all adhering bark, mud, and white wood, and the various products—billets, chips, small pieces, hollow wood, saw powder, &c.—collected and classified according to the classes represented by the specimens forming the sandal trophy. About the months of November and December auction-sales of the various classes are held in all the Kothis of the Province, and are so arranged, as regards the dates fixed for holding the same, that purchasers may, if they choose, attend the sales in Shimoga, Kadur and Hassan, and yet be in time for those in Mysore and in Bangalore.

"*Range and Yield of, and Revenue derived from, Sandalwood.*—The range, yield of wood, and the revenue derived therefrom can conveniently be shown in tabular form. The statements below contain the figures for 6 years:—

Years.	Mysore.			Shimoga.			Bangalore.			Hassan.			Kadur.		
	Collection.	Sold.	Revenue.	Collection.	Sold.	Revenue.	Collection.	Sold.	Revenue.	Collection.	Sold.	Revenue.	Collection.	Sold.	Revenue.
	Tons.	Tons.	Rs.	Tons.	Tons.	Rs.	Tons	Tons	Rs.	Tons.	Tons.	Rs.	Tons	Tons	Rs.
1882—83......	574	260	96,377	817	849	2,70,716	141¼	39½	17,049	185½	162¼	47,180	225	124	39,644
1883—84......	217¾	308¾	73,728	806	845	2,71,626	108	¾	615	241¾	211½	70,550	115½	90	20,220
1884—85......	309	393½	1,15,032	884½	140	75,643	1¼	228¼	52,595	260½	193¾	63,489	68½	48¼	12,954
1885—86......	261½	454	1,57,308	261¼	580	1,79,439	182	158½	38,405	227½	274¾	94,218	78¾	145¾	45,492
1886—87......	521½	493¾	1,46,367	396¾	754½	2,53,471	113	164	63,604	187¼	194	71,490	166	203½	75,480
1887—88......	940½	866¾	2,28,215	798¾	835¼	2,53,893	184	159¾	56,811	230¾	254¾	96,245	211¾	144½	47,281
	2,824¼	2,776¾	8,17,027	3,964¼	3,993¼	13,04,788	729½	753¼	2,29,079	1,333¼	1,291	4,43,172	865½	756	2,41,071

Average Summary calculated on the 6 *years.*

District.	Collection.	Sold.	Revenue.	Average rate per ton sold.
	Tons.	Tons.	Rs.	
Shimoga District......	660⅔	666	2,17,465	326½
Mysore do.	470⅔	463	1,36,171	294
Hassan do.	222½	215	73,862	343½
Bangalore do.	121⅔	125	38,180	305½
Kadur do.	144½	126	40,178	319

Years.	Collection.	Sold.	Revenue.	Average rate per ton sold
	Tons.	Tons.	Rs.	
1882—83	1,942¾	1,434¾	4,70,966	328¼
1883—84	1,4^{8}9	1,456	4,36,739	300
1884—85	1,523¾	1,043¾	3,19,713	306¼
1885—86	1,011	1,563	5,14,862	329½
1886—87	1,384½	1,809¾	6,10,412	337¼
1887—88	2,365¾	2,261	6,82,445	302
	9,716¾	9,568¼	30,35,137	317

" Thus, the revenue from sandalwood in 1887-88 amounted to no less than Rs. 6,82,445, while the average revenue for the 6 years reaches Rs. 5,05,856.

" There is but a slight variation between the prices obtained for the various classes of sandal at the sales held in the various Kothis of the Province, so the prices obtained last year in the Mysore District, though somewhat lower than those obtained in certain other Districts, will afford a fair idea of the value of the different classes.

"Rates obtained in auction in the Mysore District in December 1887:—

	Rs. per ton.
1st class (selected logs)	514
2nd class (do)	496
3rd class (do)	485
4th class (do)	487
5th class (logs)	471
Roots	383
Jajpokal (ordinary commercial)	352
Bagaradad (do. inferior)	372
Powder	322
Ain Bagar (inferior wood)	311
Ain Chilta (common chips)	187
Hutri Chilta (coarse do.)	168
Basola Bukni (adzed do.)	47
Milva Chips (mixed do.)	85

"The yield of sandalwood from the Mysore Province is capable of expansion. Until recently little attention was paid to artificial reproduction and the encouragement and artificial enhancement of natural reproduction, the supply being obtained solely from natural growth. Now, however, extensive measures, having for their object Sandal reproduction throughout the Province, are being carried out, and no practical limit to the possible supply of this valuable tree, beyond the necessary question of demand, is conceivable.

"*Chief Markets for Sandalwood.*—It will be matter for surprise that so valuable a wood, and one of which a single Province may almost be said to hold the monopoly, should be so little known outside India.

"The fact is that the trade in Mysore sandalwood has hitherto been confined to a ring, consisting chiefly of Muhammadan Seits, who either as principals or as agents of Bombay Firms, attend the local sales and send the sandalwood purchased by them to Bombay. The transit to Bombay from the coast is by sea in native craft. The Railways might perhaps secure this traffic if they offered special rates.

"The carts that convey the sandalwood to the coast are hired at low rates, as they are certain of return loads of salt and other merchandise to Mysore. Until recently, nearly all the sandalwood sold in the auctions held by the Mysore Government, went to Bombay, but a demand having lately arisen for sandal oil for medicinal purposes, some direct shipments of wood for extraction of oil to France and Germany, and, probably, also to America, have been made."

A small quantity of sandalwood is produced in the Madras Presidency, and in the Bombay districts of North Canara and Dharwar. The following figures show the revenue obtained from the wood in the Madras districts in 1889-90:—

North Arcot......	Rs.	5,688	Average price, Rs.	4	per cwt.
South Arcot......	„	1,385	„ „ „	15	„
Salem	„	5,679	„ „ „	15	„
North Coimbatore	„	194	„ „ „	12	„
Nilgiris	„	5,616	„ „ „	13	„
Total......		18,562			

Statement of Sandalwood collected in the North Canara and Dharwar Districts in 1889-90 *and sold by auction at Kumpta.*

No.	Class of Sandalwood.	No. of billets.	Quantity.			Rate.			Amount.		
			K.	m.	lb.*	Rs.	a.	p.	Rs.	a.	p.
1	1st class	363	18	7	20	142	4	8	2,616	2	2
2	2nd do.	472	13	3	19	140	1	7	1,847	0	9
3	3rd do.	436	7	0	2	136	6	11	955	8	10
4	4th do.	933	12	0	10	138	6	8	1,663	7	5
5	5th do.	546	4	0	11	133	0	0	534	9	11
6	6th do.	1,424	5	0	6	120	0	0	601	4	7
7	Roots	1,056	9	12	26	130	0	0	1,254	0	6
8	Jajpokal	53	1	0	0	114	0	0	114	0	0
9	Small pieces............	721	0	10	9	75	0	0	38	11	4
10	Trimmings Bags	38	3	7	16	38	0	0	128	6	2
11	Sawdust do.	3	0	4	17	90	0	0	20	11	9
·12	White wood	573	8	7	7	·16	0	0	133	12	9
	Total......	......	82	15	3	....			9,907	12	2

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* The Bombay kandy of 20 maunds of 28 lbs.

In 1889-90 the total quantity of sandalwood offered for sale in Mysore was 2,384 tons, 3 cwts., 63 lbs. Of this quantity only 2 tons, 16 cwts., 105 lbs., were placed in the first class. The total revenue yielded was Rs. 8,82,031.

The quantities sold at the different Kothis were—Hunsur Kothi, 673 tons, 13 cwts., 58 lbs.; Seringapatam Kothi, 439 tons, 11 cwts., 28 lbs.; Hassan Kothi, 180 tons, 9 cwts., 28 lbs.; Chikmangalur Kothi, 132 tons, 14 cwts., 70 lbs.; Jirthahalli Kothi, 233 tons, 13 cwts., 48 lbs.; Shimoga Kothi, 471 tons, 14 cwts., 6 lbs.; Shikapur Kothi, 252 tons, 7 cwts, 49 lbs. Of the 673 tons, 13 cwts., 58 lbs. offered for sale at Hunsur Kothi, only 148 tons, 4 cwts., 28 lbs., consisted of logs, which were classified as follows:—

	Tons.	cwts.	lbs.	Price given.
1st class	...	10	28	Rs. 601 per ton.
2nd „	6	5	84	„ 596 „
3rd „	60	4	84	„ 575 to 582 per ton.
4th „	21	3	56	„ 570 to 574 „
5th „	6	...	...	„ 554 „

The roots fetched prices ranging from Rs. 416 to Rs. 449, the sawdust Rs. 420, and the chips and trimmings from Rs. 70-8 to Rs. 301.

Sandalwood oil.—The Mysore Government has long had establishments for extracting the oil, which is sold at the annual auction along with the wood, and chiefly bought up for exportation to China and Arabia. It is procured from the wood by distillation, the roots yielding the largest quantity and finest quality of oil. The body of the still is a large globular clay pot with a circular mouth, and is about 2½ feet deep by 6½ in circumference at the bilge. No capital is used, but the mouth of the still, when charged, is closed with a clay lid having a small hole in its centre, through which a bent copper tube about 5½ feet long is passed for the escape of the vapour. The lower end of the tube is conveyed inside a copper receiver, placed in a large porous vessel containing cold water. When preparing the sandal for distillation, the white or sap wood is rejected, and the heartwood is cut into small chips, and distillation is slowly carried on for ten days and nights, by which time the whole of the oil is extracted. As the water from time to time gets low in the still, fresh supplies are added from the heated contents of the refrigerator. The quantity of oil yielded by wood of good quality is at the rate of 10 ozs. per maund, or 2·5 per cent. It is transparent and of a pale yellow colour, and has a resinous taste and sweet peculiar smell, which is best appreciated by rubbing a few drops of the oil on the warm hand. Its specific gravity is about 0·980. (*Bidie.*) The average price in India is about Rs. 8 per lb.

From Mr. Russell's report we learn that recently Messrs. F. Smith, of Bangalore, and W. F. Petrie Hay, of Hunsur, have, with permission, been making experimental distillations. Their samples were clear and good, but it has been brought to notice that the use of iced-strainers would be necessary to prevent the oil becoming thick or cloudy when exported to colder regions.

False Sandalwoods of Eastern Commerce.—The wood of **Santalum Preissii** (South Australian sandalwood) is dark-brown in colour, with unusually close tenacious texture, and extraordinarily hard and heavy. It is much sought for in China, where the oil is used for medicinal purposes and to perfume soaps. Messrs. Schimmel & Co. distilled 75 kilos of the wood and obtained 3 kilos, 800 grams, of oil. The wood, therefore, is one of the richest sandalwoods for oil. In many respects the latter is characteristic and interesting; it is viscid, of a cherry-red colour, and specifically heavier than water. At 15° C. its sp. gr. is 1·022. The oil possesses the property of solidifying at medium temperatures and separating acicular crystals, so that in the process of distillation the cooling must be very carefully effected, otherwise the condensing tubes become blocked. This phenomenon occurs especially in the medium fractions of the oil. The rasped wood has an agreeable balsamic odour with a suggestion of rose oil which is not perceptible in the normal oil. By separating the oil into a number of fractions, the rose odour can be recognised in some of the middle fractions. (*Berichte von Schimmel & Co.,* 1891.) The wood of **Santalum cignorum** (West Australian sandalwood) has a sharp odour which distinguishes it from true sandalwood. The oil, which has the same peculiarity, has a sp. gr. of 0·953, rotation +5° 20.

African Sandalwood (botanical origin unknown) is reddish-brown in colour, and very hard and close. Distilled with water it yields 3 per cent. of a ruby-red oil having the consistence of true sandalwood oil. Its sp. gr. at 15° C. is 0·969. The odour resembles that of West Indian sandal oil. (*Berichte von Schimmel & Co.,* 1891.) This wood is largely imported into Bombay; a sample kindly supplied by Messrs. Schimmel & Co. was found to agree exactly with that sold in the bazaar. It is used in India as a cheap substitute for true sandalwood.

EUPHORBIACEÆ.

EUPHORBIA PILULIFERA, *Linn.*

Fig.—*Jacq. Icon., t.* 478; *Burm. Thes. Zeyl., tt.* 104—105, *f.* 1.

Hab.—Throughout the hotter parts of India. The herb.

Vernacular.—Dudhi (*Hind.*), Bara-keru (*Beng.*), Goverdhan, Mothidudhi, Nayeti (*Mar.*), Dudheli (*Guz.*), Amumpatchai-arissi (*Tam.*), Bidari, Nánabala (*Tel.*), Gentikasa, Barasu (*Can.*).

History, Uses, &c.—This plant is not mentioned by Hindu medical writers, nor does there appear to be any Sanskrit name for it. It is known, however, as a popular remedy for worms, bowel complaints, cough and gonorrhœa, and as a local application for the cure of ringworm, the Marathi name *Nayeti* signifies ringworm. Ainslie (ii., 99) remarks:—"If we may believe Piso (*De Med. Brazil*), and Barham (p.180), it possesses most extraordinary qualities, such as a few drops of the juice of it killing serpents; its efficacy in venereal complaints and dry bellyache; and its being an antidote to poisons."

Recent investigation has, however, thrown more light upon the properties of the plant. Marsset has discovered that it kills small animals by paralysing the respiration and the heart, through its direct action on the respiratory and cardiac centres. The active principle is eliminated by the liver, for in all the animals which died during the experiments the gall-bladder was found to be distended with bile. He has published excellent results obtained with it in the dyspnœa of asthma, emphysema and bronchitis, these good results depending upon a particular modification of the functions of the pneumogastric. (*Contrib. à l'étude bot. phys. et therap. de l'Euphorb. pil.* Paris, 1884.) Tison and Beaumetz obtained very satisfactory results from it in dyspnæa of cardiac origin. It appears to act beneficially upon spasmodic dyspnæa, from whatever cause arising, and it unquestionably is a remedy of great power and promise. (*Whitla.*) Its action is not cumulative. The active principle being soluble in water and dilute alcohol, an abundant watery vehicle should therefore be employed. An extract made with water or weak spirit keeps well. In decoction, 1 oz. of the fresh plant or ½ oz. of the dried plant may be used with 2 quarts of water, and be reduced by simmering to one quart; the addition of 1½ to 2 ozs. of alcohol will prevent it from spoiling in a cold climate, but in India the decoction should be made fresh every 2 days. The extract may be given in 1 gram doses, dissolved in syrup or water; it should not be prescribed in pill, on account of its irritant action on the gastric mucous membrane. The decoction is given in doses of a wine-glassful three or four times a day; both preparations are best given after meals or immediately before them. Attention has been redirected to this drug, as of value in the treatment of hay asthma and coryza, by Dr. Rosecrans Workman (*Therap. Gaz.*, July 15, 1890), who states that in thirteen cases of hay asthma, prompt relief was obtained in nine, in one of the other cases partial relief was obtained, and in the remaining three cases the results were negative. The fluid extract was administered in doses of 30 to 60 minims every four hours. In nearly all the above cases iodide of potassium and arsenic had been previously used. In nine cases of coryza, good results were obtained in six, the sneezing and rhinal flow ceasing or diminishing within thirty-six hours after the administration of the drug was begun. The doses were repeated every three or four hours. In five cases of asthma of frequent recurrence and long standing, marked relief was experienced in one case: the dyspnœa soon disappeared and the attacks were always shortened. In the other four cases no good effects were obtained.

Description.—Annual, hairy, obliquely-erect, with the apices recurved; leaves opposite, obliquely-oblong, serrulate; flowers small, numerous, in globular, axillary, shortly-peduncled clusters; seeds ovoid. The acute leaves, hispid hairiness, and small fruit render this species easily recognizable.

Chemical composition.—The plant has been examined by J. H. Bunting (*Amer. Journ. Pharm.*, 1888, 552), whose analysis shows the presence of the following constituents: wax, caoutchouc, chlorophyll, resin, tannin, sugar, mucilage, carbohydrates, albuminoids, calcium oxalate, and other salts.

Nothing is known of the active principle beyond the facts that it is soluble in water and weak spirit, and insoluble in alcohol of 90°, ether, chloroform, bisulphide of carbon and oil of turpentine; it is supposed to be a gum-resin. The watery solution on evaporation to dryness leaves a deep reddish-brown substance, having a vitreous fracture, hardly any taste and a strawberry odour. (*Bardet et Egasse, Form. des Nouv. Remèdes*, Paris, 1886.)

EUPHORBIA THYMIFOLIA, *Burm.*

Fig.—*Burm. Thes. Zeyl.*, *t.* 105, *f.* 2; *Rheede, Hort. Mal. x.*, *t.* 33.

Hab.—Throughout India and Ceylon, Central Asia, and all hot countries, except Australia.

Vernacular.—Chhoti-dudhi, Nigáchúni (*Hind.*), Rakta-keru, Dudhiya (*Beng.*), Chin-amam-patchai-arissi, Sittrapaládi (*Tam.*), Bidari-nána-biyyam (*Tel.*), Dákti-dudhi, Lahan-nayeti (*Mar.*), Dodhuk, Hazárdána (*Punj.*).

History, Uses, &c.—This plant is not mentioned in the standard Sanskrit medical works, but, along with the allied species *E. granulata*, Forsk., *E. microphylla*, Heyne, and *E. Clarkeana*, Hook *f.*, which the natives do not distinguish from it, it is used medicinally in most parts of India and the East. The author of the *Khulásat-el-tajárib* states that it is a small milky prostrate plant with slender reddish stems, and opposite leaves about the size of a split lentil seed, very common about Merv in sandy ground. It is hot and dry in the first of the third degree; the expressed juice or powdered plant with wine is given as a remedy for the bites of venomous reptiles, and is applied externally to the bitten part; with milk it acts as a purgative and expels all noxious humors from the body. According to Ainslie, the Sanskrit name is Rakta-vindu-chhada, which would imply that it is a remedy for *Rakta-vindu*, "gonorrhœa with sanious discharge." He remarks:—"The very small leaves and seeds of this low-growing annual plant, which, in their dried state, are slightly aromatic and a little astringent, are given by the Tamool doctors, in worm cases, and in certain bowel affections of children; they are commonly administered in the form of powder, and in buttermilk, to the quantity of one pagoda and a quarter weight in the course of the day on an empty stomach. The leaves when carefully dried smell something like tea." (*Mat. Ind.*, ii., 75.) Irvine states that it is used as a stimulant and laxative in Northern India. In the Concan the juice is used to cure ringworm, and mixed with chloride of ammonium for the cure of dandriff. O'Shaughnessy says that the juice is a violent purgative, and that the fresh plant is, by the Arabs, applied to wounds. In the *Dict. Econ. Prod. of India*, it is stated, on the authority of the Rev. A. Campbell, that the Santals use the root of this plant, which they call Nanha-pusi-toa, as a remedy for amenorrhœa.

Description.—A much branched annual prostrate plant, more or less hispidly pubescent, leaves opposite, ⅙ to ⅓ inch, petioled, obliquely-oblong, obtuse, crenulate, glabrous or pubescent beneath, stipules elongate, involucres subsolitary, very minute, axillary, especially in the crowded terminal branchlets, lobes short ciliate, glands very minute, stipitate; capsules erect, obtusely keeled, pubescent; seeds with 5 to 6 shallow transverse furrows.

Chemical composition.—An alcoholic extract of the whole plant was mixed with water acidulated with sulphuric acid, and successively agitated with petroleum ether and ether, and then reagitated with ether from the solution rendered alkaline with sodic carbonate. The petroleum ether extract contained a large amount of colouring matter; it had a very faint bitter taste; on standing, dark, and what appeared to be crystalline, points separated, but which, on microscopic examination, were destitute of regular structure. Euphorbon was specially sought for, but we arrived at no definite conclusion relative to its presence.

The acid ether extract was of a greenish colour, and partly soluble in water, the solution giving a greenish coloration with ferric chloride, and precipitating gelatine, but giving no reaction with cyanide of potassium.

After washing off by cold alcohol the extractive adhering to the sides of the capsule, and which was insoluble in water, a sulphur-yellow deposit was left, which, on microscopic examination, consisted of very minute needles. This principle was present in only minute traces, and was soluble even in warm alcohol with difficulty; it gave the reactions of quercitrin.

The aqueous original acid solution, before the addition of sodic carbonate, was of a bright claret colour; on the addition of the alkali sage-green flocks separated, the addition of acids causing solution, and reproducing the original claret-coloured solution; but after standing, the flocks became insoluble in acids, and only a faintly yellowish-red tint was produced by their addition.

The alkaline ether extract contained an alkaloidal principle which crystallized in fine colourless feathery crystals; it possessed no bitter taste. With Fröhde's reagent in the cold a very faint-yellow tint was produced, which was changed to greenish on gently warming. Concentrated nitric acid gave a yellowish tint. Sulphuric acid and potassium bichromate no colour reaction.

EUPHORBIA TIRUCALLI, *Linn.*

Fig.—*Rheede, Hort. Mal. ii., t.* 44. Milk-bush (*Eng.*), Euphorbe antivenérien (*Fr.*).

Hab.—Africa. Cultivated in India and the East. The juice and bark.

Vernacular.—Bár-ki-thohar, Bár-ki-sehund (*Hind.*), Káda-nivali (*Mar.*), Netrio-thora, Thora-dánadálio (*Guz.*), Kalli-kombu (*Tam.*), Káda-jemudu (*Tel.*), Bonta-kalli, Káda-nevali (*Can.*), Tiru-kalli (*Mal*), Lanka-sij (*Beng.*).

History, Uses, &c—This shrub has been introduced into the East from Africa, and is much used for making fences round cultivated fields, as cattle will not break through it owing to the acrid nature of the milky juiee. The earliest notice of *E. Tirucalli* that we know of is in the *Kámus,* which was written about the middle of the 14th century; it is there called دهن (dihan), the name by which it is still known in Arabia (*Forskahl*), and is described as a noxious plant, used to poison wild beasts. The plant is not mentioned in the Nighantas, but the juice is in general use among the natives of India as a purgative, and, applied locally, as a counter-irritant. Rheede states that a decoction of the root is given in certain cases of colic, and that the milky juice mixed with melted butter is prescribed as a purge. It is the *Ossifraga lactea* of Rumphius, who says that the bark is applied in Java to fractures. According to Horsfield, the Javanese, who call it *Kayoo-oorb,* also use it as a vesicant. Virey (*Hist. Nat.*, p. 299) says:—Il guérit très bien l'affection venérienne; il est aussi purgatif et vomitif." Loureiro notices its caustic nature: "Occulos si tangat excæcat." (*Ainslie, Mat. Ind.*, ii., 133 and 425.) In the Concan 1 to 4 drops of the milky juice are given with treacle or the flour of *Cicer arietinum* as a purge, and the charcoal, which is very light, is used in making pastilles. Dr. G. Y. Hunter speaks of the juice as a good application in neuralgia. In Goa it is used for poisoning fish.

Description.—A shrub or small tree, 15—20 feet, with numerous slender branches, smooth, and of a bright-green colour, having a few, most minute leaves at the extremities, which soon fall off; as the plant grows older, the stalks become stronger, and at length woody and of a brown colour. The wood of old trees is white, close-grained and strong; it produces a good charcoal for gunpowder and other purposes.

Chemical composition.—See next article.

EUPHORBIA NERIIFOLIA, *Linn.*

Fig.—*DC. Plant. Grasses, ii., t.* 46; *Rumph. Herb. Amb. iv., t.* 40.

Hab.—Deccan Peninsula, Beluchistan, Malay Islands. Cultivated elsewhere. The juice and root.

Vernacular.—Sehund, Thohar (*Hind.*), Mansa-sij, Páta-sij (*Beng.*), Nevadunga, Mingút (*Mar.*), Thohar-kántáro (*Guz.*), Ilaik-kalli (*Tam.*), Áku-jemudu (*Tel.*), Yale-kalli (*Can.*), Elak-kalli (*Mal.*).

EUPHORBIA ANTIQUORUM, *Linn.*

Fig.—*Wight Ic., t.* 897; *Rheede, Hort. Mal. ii., t.* 42.

Hab.—Throughout the hotter parts of India and Ceylon. The juice and root.

Vernacular.—Tidhára-sehund (*Hind.*), Tekáta-sij (*Beng.*), Tridhári-nevadunga, Nara-seja (*Mar.*), Shadhurak-kalli (*Tam.*), Bomma-jemudu (*Tel.*), Mudu-mula-kalli (*Can.*), Katak-kalli (*Mal.*), Tandhári-thohar (*Guz.*).

History, Uses, &c.—These two plants are included under the Sanskrit names of Snuhi, Sehunda, Vajra, Vajra-tundi, Vajra-dantaka, Gandira and Maha-taru, and are supposed to ward off lightning strokes, on which account they are sometimes cultivated in pots placed on exposed positions in Hindu houses. They are sacred to Mansá, the goddess of serpents. In some parts of India, in July and August, on Tuesdays and Thursdays, the natives approach the trees with offerings of rice, milk, and sugar, praying to be delivered from snake-bites. They also employ the root mixed with black pepper as a medicine for the cure of snake-bites internally and externally. Dutt informs us that in Bengal, on the fifth day after the full moon of the month Srawan, *E. neriifolia* is planted in the courtyard of Hindu houses and worshipped.

In Western India there is a curious custom among the Concani Brahmins in connection with this plant. At the time of the Dewali they cut a portion of the stem, hollow it out, and fill it with oil, in which they place a wick. The little lamp thus formed is lighted and carried from house to house with the object of depositing it unextinguished in the house of some friend or acquaintance, saying at the same time, "A son-in-law for you," that is, wishing them good fortune (Nevadunga). The people of the house pretend not to want it, and try to extinguish the light by throwing water at it. These lamps are also placed upon little heaps of cowdung and worshipped.

In the Nighantas the plants are described as purgative, pungent, digestive, bitter and heavy, and are said to be useful in constipation, flatulent distention, tumours, swellings, abdominal enlargements, rheumatism, spleen, leprosy, mania and jaundice.

They abound in an acrid milky juice, which is a popular application to warts and other cutaneous affections. The native doctors purify arsenious acid by packing it in a hole made in a piece of the stem, closing the hole and exposing the stem to the action of fire until it is charred. The milky juice of *E. neriifolia* is usually administered internally by soaking other purgatives and aromatics in it, so that by absorption of the juice their purgative properties become increased. A similar method is adopted when the juice is applied externally, a tent or issue pea being prepared with some finely powdered drug and steeped in it. Ainslie tells us that the native practitioners prescribe the juice as a purge and deobstruent, in those visceral obstructions and dropsical affections which are consequent of long-continued intermittent fever, the quantity given for a dose being about ¼ of a pagoda weight (20 grs.). Externally, mixed with margosa oil, it is applied to limbs which have become contracted from rheumatism. (*Mat. Ind.*, Vol. II., p. 97.) In Bombay the root is mixed with country liquor to make it more intoxicating, and the juice is used to kill maggots in wounds, and is dropped into the ear to cure earache, a practice common to many parts of India. In the Concan the stem is roasted in ashes, and the expressed juice, with honey and borax, given in small doses to promote the expectoration of phlegm; sometimes the juice of *Adulsa* is added. For asthma, *Mudar* flowers, *Aghada* root, and *Gokaran* root are steeped in the juice, powdered and given with honey and chebulic myrobalans. Dose about 4 grains. The author of the *Makhzan-el-Adwiya*, under the name of Zakúm (Euphorbia), describes four Indian species, which are probably *E. antiquorum*, *E. neriifolia*, *E. Nivulia* and *E. Tirucalli*. The milky juice of the first, he says, is mixed with the flour of *Cicer arietinum*, roasted, and administered in pills as a remedy for gonorrhœa. It has a strong purgative action. The juice of the second and third species is heated and dropped into the ear for the cure of earache; heated with salt it is given as a remedy in whooping cough, asthma, dropsy, leprosy, enlarged spleen, dyspepsia, jaundice, flatulence, colic, calculus, tumours, &c. The fourth species yields a milky juice, having similar properties. Sprengel identifies *E. neriifolia* with the مهودانه (Mahúdáneh) of Ibn Sina, also called Hab-el-mulúk, a purgative seed of a reddish brown colour and like a vetch.* The author of the جامع jocosely remarks that the name should be ماهو بذاته and says:— ای قایم بنفسه ای انه یقوم بذاته فی الاسهال "it is sufficient as a purgative without the assistance of any other drug." Ibn Sina describes Mahúdaneh as tricoccous and like a large filbert; he says, the name of the plant is Shibáb. It cannot be *E. neriifolia*, which has seeds no larger than a grain of mustard. In the *Dict. of Econ. Prod.*, published by the Government of India, it is stated, on the authority of Dr. J. H. Thornton, that the juice of *E. antiquorum* mixed with burnt borax and common salt is used as an application to painful joints and swellings. Dr. Thornton says:—"The fresh milky juice is a direct irritant both when taken internally and applied externally. Taken in very small quantities, it is a drastic purgative." *E. trigona*, Haworth, the Kạttimandu or "knife medicine" of the Telugus, so named because it is used for fixing knife blades in their handles, and *E. Nivulia*, Ham., have similar properties.

Description.—*E. neriifolia* is a small, fleshy, glabrous tree or shrub, branches jointed, cylindric or obscurely 5-angled, with short, sharp stipular thorns arising from thick tubercles; leaves deciduous, fleshy, obovate oblong or obovate-acute; involucres in small, stout, dichotomous, short-peduncled cymes from the sinuses, hemispheric, smooth, styles connate high up, undivided, cocci compressed, glabrous; the fruit is tricoccous, but so deeply divided that it has the appearance of three radiating slender follicles. The seed is about the size and shape of a grain of mustard, and of a greyish-brown colour.

E. antiquorum is an erect, fleshy, glabrous tree or shrub, branches terete or obscurely 3—6 angled, branchlets with 3—5 thick sinuate wings, and a pair of sharp stipular thorns in the sinuses; leaves few and small, from the sides of the wings, fleshy, obovate oblong, tip rounded; involucres 3-nate, forming short-peduncled cymes in the sinuses, styles free, 2-lobed, cocci compressed, glabrous.

E. Nivulia and *E. trigona* are very similar shrubs.

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* Hab-el-mulúk is the seed of *Croton Tiglium*.

Chemical composition.—Henke (*Archiv. d. Pharm.*, Vol. 224 (1886), 729—759) has ascertained that the dried juice of Kattimandu (*E. Nivulia*) contains 35 per cent. of *Euphorbon*, 25·40 per cent. of resin soluble in ether, 13·70 of resin insoluble in ether, 1·50 per cent. of caoutchouc, and the other constituents of commercial *gum euphorbium.* The dried juice of *E. Tirucalli* was also found to be of a similar nature, and to contain 4 per cent. of caoutchouc. Henke examined the juice of sixteen species of Euphorbia and ascertained that they all contain euphorbon, so that we may fairly suppose it, as well as an acid resin, malate of calcium, and caoutchouc, to be a constant constituent of the milky juice of all the plants belonging to the genus. (*See next article.*)

EUPHORBIA RESINIFERA, *Berg.*

Fig.—*Jackson, Account of Morocco, t.* 6; *Berg. et Sch., t.* 34 d, *f.* M—X; *Bentl. and Trim.* 240.

Hab.—Morocco. The dried juice (Gum Euphorbium).

Vernacular.—Farbiyun, Afarbiyun, Farfiyun (*Ind. Bazars*).

History, Uses, &c.—Euphorbium was known to the ancients. Dioscorides and Pliny both describe its collection on Mount Atlas in Africa, and notice its extreme acridity. According to the latter writer, the drug received its name in honour of Euphorbus, Physician to Juba II., King of Mauritania. This monarch, who, after a long reign, died about A.D. 18, was distinguished for his literary attainments, and was the author of several books, which included treatises on opium and euphorbium. The latter work was apparently extant in the time of Pliny.

Euphorbium is mentioned by numerous other early writers on medicine, as Rufus Ephesius, who probably flourished during the reign of Trajan, by Galen in the 2nd century, and by Vindicianus and Oribasius in the 4th. Ætius and Paulus Ægineta, who lived respectively in the 6th and 7th centuries, were likewise acquainted with it; and it was also known to the

Arabian school of medicine. In describing the route from Aghmat to Fez, El-Bekri of Granada, in 1068, mentioned the numerous plants of *El-Farbiyun* growing in the country of the Beni Ouareth, a tribe of the Sanhadja. (*Pharmacographia.*) Ibn Sina notices the drug under the name of Farbiyun; Haji Zein states that it is called Farbiyun, Afarbiyun, Farfiyun and Tákúb, and that the men who collect it have to tie up their faces to prevent the dust entering their mouths, as it would cause all their teeth to fall out. He says that as soon as it is collected, it is mixed with husked beans to preserve its strength, and that when fresh it is of a yellow colour, translucent, and easily soluble in olive oil; when old it turns reddish-yellow, the odour is acrid. As regards its medicinal properties, he states that it is a useful application in sciatica, palsy, colic, lumbago, and removes phlegmatic humors from the joints and limbs; internally administered it acts as a purgative of bile and phlegm. However used, it should always be diluted with such substances as oil of roses (fatty extract), bdellium, extract of liquorice, tragacanth or gum arabic; the dose is from one carat to one dang. When given internally to women, it causes abortion, but a pessary containing one grain of euphorbium causes the mouth of the uterus to contract and prevents abortion. Mixed with honey it is used in purulent ophthalmia. Three dirhams is a fatal dose, causing ulceration of the stomach and intestines; the antidotes for it are sour milk, the juice of sour pomegranates, and camphor.

The author of the *Tuhfat-el-muminin* gives almost a literal translation of what Dioscorides says about euphorbium, and reproduces a great part of Haji Zein's account of it; he mentions its use as a snuff, when diluted with beet juice, in certain affections of the brain, as a dusting powder to remove proud flesh, and as an enema in obstructed menses. In modern medicine, euphorbium is never given internally, but it is still sometimes employed as an errhine, after having been largely diluted with some inert powder, in amaurosis, deafness, and other chronic brain diseases. Its use as a counter-irritant is now almost entirely confined to veterinary practice.

Description.—The drug consists of irregular pieces, seldom more than an inch across and mostly smaller, of a dull yellow or brown waxy-looking substance, among which portions of the angular spiny stem of the plant may be met with. The substance is brittle and translucent, and has a somewhat aromatic odour; it is extremely acrid, and the dust is powerfully irritant if inhaled.

Chemical composition.—An analysis of selected fragments free from extraneous matter by Flückiger (*Vierteljahresschrift fur prakt. Pharm.*, xvii. (1868), 82—102) shows the composition of the drug to be as follows:—

Amorphous resin, $C^{10}H^{16}O^{2}$	38
Euphorbon, $C^{15}H^{22}O$	22
Mucilage	18
Malates, chiefly of calcium and sodium	12
Mineral compounds	10
	100

The amorphous resin is readily soluble in cold 70 per cent. alcohol. The solution has no acid reaction, but an extremely burning acrid taste. By evaporating the resin with alcoholic potash, and neutralizing the residue with a dilute acid, a brown amorphous substance, the *Euphorbic Acid* of Buchheim, is precipitated. It is devoid of acridity, but has a bitterish taste. From the drug, deprived of the amorphous resin ether or petroleum takes up the *Euphorbon,* which may be obtained in colourless, although not very distinct, crystals, which are at first not free from acrid taste, but by repeated crystallizations, and finally boiling in a weak solution of permanganate of potash, may be so far purified as to be entirely tasteless. Euphorbon is insoluble in water; it requires about 60 parts of 80 per cent. alcohol for solution at ordinary temperatures. In boiling alcohol it is freely soluble, also in ether, benzole, amylic alcohol, chloroform, acetone or glacial acetic acid.

Euphorbon melts at 113 to 116° C. without emitting any odour. By dry distillation a brownish oily liquid is obtained, which requires further examination. If euphorbon dissolved in alcohol is allowed to form a thin film in a porcelain capsule, and is then moistened with a little concentrated sulphuric acid, a fine violet hue is produced in contact with strong nitric acid slowly added by means of a glass rod. The same reaction is displayed by lactucerin, to which in its general characters euphorbon is closely allied. If a few drops of an alcoholic solution of euphorbon are allowed to dry on a piece of filtering paper, and then touched with a drop of nitric acid, a blue colour will be developed.

Pure euphorbon, according to Henke, melts at 67° to 68°; its composition was found to be $C^{20}H^{36}O$. Its rotatory power dissolved in chloroform was $[\alpha]_D = +15\cdot^\circ 88$. Hesse assigns to euphorbon the formula $C^{15}H^{24}O$.

The mucilage of euphorbium is precipitated by neutral acetate of lead, as well as silicate or borate of sodium, it therefore does not agree with gum arabic.

If an aqueous extract of euphorbium is mixed with spirit of wine, and the liquid evaporated, the residual matter assumes a somewhat crystalline appearance, and exhibits the reactions of *Malic Acid.* Subjected to dry distillation, white scales and acicular crystals of *Maleic* and *Fumaric acids*, produced by the decomposition of the malic acid, are sublimed into the neck of the retort. (*Pharmacographia*, 2nd Ed., p. 560.)

Toxicology.—Euphorbium causes the eyes to weep and grow red, the nose to run with watery and even bloody mucus, and saliva to flow abundantly from the mouth. To prevent these effects, says Pereira, some drug-grinders employ masks with glass-eyes, others apply a wet sponge to the nose and face, while others cover the face with crape. Individuals who have been exposed for some time to the influence of this dust suffer with headache, giddiness, and ultimately become delirious. I was informed, he adds, of an Irish labourer who was made temporarily insane by it, and who, during the fit, insisted on saying his prayers at the tail of the mill-horse. In a case which fell under his notice a man grew suddently delirious, and presently became insensible and fell in a fit. His face was red and swollen, his pulse frequent and full, and his skin very hot. On being bled, his consciousness returned and he complained of great headache.

Under Euphorbiaceæ, Norman Chevers, quoting Dr. H. Cleghorn of Madras, says:—"There are several species of Euphorbia, as the *E. neriifolia, antiquorum, acaulis,* and others which abound in a milky juice. This produces a blister when rubbed on the integuments, and serious inflammation if dropped into the eye. Several cases have happened within my knowledge, where the sight has been endangered from this cause." (*Indian Med. Jurisprudence.*)

Other species of Euphorbia found in India, and occasionally used medicinally, are **E. helioscopia,** *Linn.*, the Sun Spurge, a native of Afghanistan and the Punjab, **E. hypericifolia,** *Linn.*, and **E. Royleana,** *Boiss.*, a native of the outer Himalaya.

E. helioscopia is used as a hydragogue cathartic, and the juice is applied to remove warts. Dr. Baudry (*Bull. Med. du Nord,* 1887) has reported a case of severe ulceration resulting from the application of a poultice of the bruised plant.

E. hypericifolia has not unfrequently been mistaken for *E. pilulifera,* but may be distinguished readily by its not having the hairy stem of the latter plant. In Réunion it is used as an astringent in dysentery under the name of *Herbe Jean-Robert.*

PHYLLANTHUS EMBLICA, *Linn.*

Fig.—*Brand. For. Fl., t.* 52; *Bedd. Fl. Sylv., t.* 258; *A. Juss. Tent. Euphorb., t.* 5, *f.* 15; *Rheede, Hort. Mal. i., t.* 38. Emblic myrobalan (*Eng.*), Emblic officinal (*Fr.*).

Hab.—Throughout tropical India. The fruit, bark, and flowers.

Vernacular.—Ánvula (*Hind.*), Ámlaki (*Beng.*), Ávala, Avalkáthi (*Mar.*), Nelli-kai, Toppi (*Tam.*), Nelli-kaya, Usirike-kaya (*Tel.*), Nelli-kaya (*Mal.*), Nelli-kayi (*Can.*), Ambala (*Guz.*).

History, Uses, &c.—The fruit of this tree is the Dhâtriphala, Amritaphala, Ámalaka or Sriphala of the Nighantas, and is described as having all the properties of the chebulic myrobalan. It is used both fresh and dried; in the former condition it is considered to be refrigerant, diuretic and laxative; in the latter, astringent. It is pickled by the natives, and, on account of a peculiar flavour which it imparts, some of the forest tribes eat it before drinking water. A sherbet of the fruit, sweetened with sugar or honey, is a favourite cooling drink for sick people; it is said to be diuretic. A country-side prescription for biliousness in the Concan is *Avala*, 4 massas, to be soaked all night in water, and in the morning to be pounded and mixed with a quarter seer of milk and flavoured with sugar and cumin. Emblic myrobalans are an ingredient in many compound preparations described in Sanskrit works. A selection of these prescriptions will be found in Dutt's *Hindu Materia Medica;* the following, translated from Chakradatta, may be taken as an example:—

"*Dhâtri lauha.*—Take of powdered Emblic myrobalans 64 tolás, prepared iron 32 tolás, liquorice powder 16 tolás, mix them together, and soak in the juice of *Tinospora cordifolia* seven times successively. This preparation is given in jaundice, anæmia and dyspepsia, in doses of from 20 to 40 grains."

Mahometan physicians esteem this myrobalan equally with the Hindus; they describe it as astringent, refrigerant, cardiacal, and a purifier of the humors of the body. It is much prescribed by them in fluxes, and is also applied externally on account of its cooling and astringent properties The Arabic name is Amlaj, and the Persian Ámala. Ainslie states that the flowers, which have an odour resembling that of lemon peel, are supposed by the Vytians to have virtues of a cooling and aperient nature, and are prescribed in conjunction with other articles in the form of an electuary. (*Mat. Ind.*, ii., p. 244.) In the *Pharmacopœia of India* it is stated, upon the authority of Dr. Æ. Ross, that the root by decoction and evaporation yields an astringent extract equal to catechu, both for medicinal purposes and in the arts; the chips of the wood or small branches thrown into impure or muddy water, according to the same authority, clear it effectually. In the Concan the juice of the fresh bark, with honey and turmeric, is given in gonorrhœa.

Description.—Fresh Emblic myrobalans are globular, fleshy, smooth, six-striated, of a yellowish-green colour, and sometimes as large as a walnut; they contain an obovate obtusely triangular, 3-celled nut, each cell of which contains two triangular seeds. The taste of the pulp is acid, astringent, and somewhat acrid. The dried fruit is the size of a cob nut, subhexagonal, wrinkled, of a grey-black colour if it has been collected when immature, but yellowish-brown if mature; the latter upon pressure breaks up into six parts, each of which consists of a section of the pulp and nut, and contains one triangular brown seed.

Chemical composition.—The pulpy portion of the fruit dried at 100°C., and freed from the nuts, had the following composition:—

Ether extract (gallic acid, &c.)	11·32
Alcoholic „ (tannin, sugar, &c.)	36·10
Aqueous „ (gum, &c.)	13·75
Soda „ (albumen, &c.)	13·08
Crude cellulose	17·80
Mineral matter	4·12
Moisture and loss	3·83
	100·00

The acidity of the fruit was found to be equal to 9·6 per cent., calculated as acetic acid. The amount of tannic acid, estimated with acetete of lead solution, was 35 per cent., and 10 per cent. of glucose was estimated by means of Fehling's solution on an infusion of the pulp after the removal of the tannin.

Löwe considers this tannin to be identical with the ellagotannic acid of Divi-divi.

Commerce.—Two kinds of Avala are found in commerce, one entire, and the other cut up, and the nut removed. The fruit is collected in many parts of India. Value, about Rs. 32 per candy of 7 cwts.

PHYLLANTHUS RETICULATUS, *Poir.*

Fig.—*A. Juss. Tent. Euphorb.* 19, *t.* 4, *f.* 1; *Wight Ic.*, *t.* 1899; *Burm. Thes. Zeyl.*, *t.* 88.

Hab.—Throughout tropical India. The leaves and bark.

Vernacular.—Pánjoli (*Hind.*), Púlagúda (*Tel.*), Púlavayr (*Tam.*), Pánkúshi (*Beng.*), Pavana, Puvana (*Mar.*), Kamohi (*Sind.*), Datwan (*Guz.*), Katu-nirúri (*Mal.*).

History, Uses, &c.—Ainslie (*Mat. Ind.*, ii., 223) gives Krishna-kámboji as the Sanskrit name of this plant. Kámboja, "coming from Kámboj," is applied in that language to several plants, but none of them have been identified with *P. reticulatus*, nor does it appear to be mentioned in the Nighantas under any other name. The leaves and bark are used as a diuretic and cooling medicine and as an alterative. Ainslie says:—"This bark, as it appears in the Indian bazars, is commonly in pieces about a foot long, and as thick as the wrist, of a dark colour outside, and of a faint sweetish taste; it is considered as alterative and attenuant, and is prescribed in decoction, in the quantity of 4 ounces or more twice daily." In the Concan the juice of the leaves is made into a pill with camphor and cubebs, and dissolved in the mouth as a remedy for bleeding from the gums; it is also, along with the juice of other alterative plants, reduced to a thin extract, and made into a pill with aromatics. This pill is given twice a day, rubbed down in milk, as an alterative in heat of blood.

Description.—Shrubby, climbing, primary branches twiggy; young shoots pubescent; floriferous branchlets angular; leaves oval-obtuse, bifarious; flowers axillary, aggregated, several males and usually one female; male flowers purplish; berries size of a pea, dark-purple. This plant is common near water, and extends to Sind, where it is found in the forests of great size, climbing to the tops of the highest trees. (*Bomb. Flora.*) The flowers have a peculiar and disagreeable smell. The bark is dark-brown externally, and thickly studded with little elliptic warty rings; beneath the suber is a deposit of chlorophyll, but the substance of the bark is of a dull-red colour. Taste sweet and astringent. Microscopically there is little to remark beyond masses of deep purple pigmentary matter and groups of large stone cells.

Chemical composition.—The leaves contained a tannic acid similar to that separated from other species of this genus, but no alkaloid. A crystalline principle soluble in ether was removed from the aqueous solution of the alcoholic extract; it gave a yellowish-brown colour with sulphuric acid, a brown colour with Fröhde's reagent, and a yellow solution with alkalies. The powdered air-dried leaves afforded 7·83 per cent. of ash, and when mixed with water became very mucilaginous, and it was very difficult to filter this mixture through paper.

Phyllanthus madraspatensis, *Linn., Wight Ic.,* 1895, *f.* 3, yields the Kanocha seed of the bazars. The seeds are polished, triangular, of a grey colour, prettily marked with delicate dark-brown lines like basket-work; length $\frac{1}{10}$ of an inch; breadth somewhat less; one side is arched, the other presents two sloping surfaces united to form a longitudinal ridge, at the pointed end is a small scar marking the attachment to the ovary; the testa is hard and brittle. When soaked in water they immediately become thickly coated with a semi-opaque mucilage; the kernel is oily and has a sweet nutty taste; the seeds are used medicinally on account of the mucilage which they afford.

PHYLLANTHUS NIRURI, *Linn.*

Fig.—*Wight Ic., t.* 1894; *Rheede, Hort. Mal. x., t.* 15.

PHYLLANTHUS URINARIA, *Linn.*

Fig.—*Wight Ic., t.* 1895, *f.* 4; *Rheede, Hort. Mal. x., t.* 16.

Hab.—Throughout India. The herbs.

Vernacular.—Bhumi-a'nvala (*Hind.*), Bhui-amla (*Beng.*), Bhui-a'vala (*Mar.*), Kizhkay-nelli (*Tam.*), Nelli-usirika (*Tel.*), Kizha-nelli (*Mal.*), Kiranelli-gida (*Can.*), Bhui-amali (*Guz.*). *P. urinaria* is distinguished by the addition of the adjective red to the above names.

History, Uses, &c.—These plants are common weeds which appear in the cold season. They are called in Sanskrit Támra-valli (*P. urinaria*) and Bhumy-ámali (*P. Niruri*), and bear among other synonyms those of Tamalika, Bhu-dhátri, and Bahu-pattra, "having many leaves." Hindu physicians consider them to be deobstruent, diuretic, astringent and cooling, and prescribe the dried plant in powder or decoction in jaundice. The dose of the powder is about a teaspoonful. Mir Muhammad Husain in the *Makhzan* states that the milky juice is a good application to offensive sores, and that a poultice of the leaves with salt cures scabby affections of the skin; without salt it may be applied to bruises, &c. From Ainslie we learn that these two plants are the *Herba mœroris alba* and *rubra* of Rumphius, and that an infusion of the leaves of *P. Niruri* with fenugreek seed is considered a valuable remedy in chronic dysentery, also that the leaves are a good stomachic bitter. In Bombay *P. Niruri* is used as a diuretic in gonorrhœa and acidity of the urine. The dose is 2 tolás of the juice with 2 tolás of ghí twice a-day. The root rubbed down with rice-water is given in the Concan as a remedy for menorrhagia.

Dr. A. J. Amadeo states that the plant is known as *Yerba de quininic* at Porto-Rico, and is used in decoction in intermittent fevers; he thinks favourably of it, and uses a tincture in 2-drachm doses; it acts as a gentle purgative, and is especially useful when the liver and spleen are infarcted. It is diuretic.

Description.—*P. Niruri:* Annual, erect-branched; branches herbaceous, ascending; floriferous branchlets filiform; leaves elliptic, mucronate, entire, glabrous; male and female flowers in separate axils, male on the lower ones; dehiscence of anthers transverse; glands in the female bifid and trifid; capsule globose; two smooth seeds in each cell; seeds triangular.

P. urinaria: Root generally annual, though in some soils biennial and even perennial. Stem erect, striated, of a pale reddish colour; branches several, ascending, striated from the insertions of the stipules; leaves scattered, spreading, pinnate, from one to two inches long, flower-bearing; leaflets alternate, linear oblong, entire, smooth, ¾ of an inch long, and ¼ broad; petioles compressed, somewhat triangular; stipules of the petioles 3-fold, acute, membranaceous, those of the leaflets two, lateral; male flowers, exterior leaflets axillary, 2 to 3, subsessile; calyx, nectary and stamens as in *P. Niruri*; female flowers, lower leaflet axillary, solitary, sessile; calyx and nectary as in the male; capsules scabrous, 3-celled, 6-valved; seeds, two in each cell, transversely striated on the outside. It is immediately distinguished from *P. Niruri* by its sessile flowers and scabrous capsules. (*Roxb.*)

Chemical composition.—The alcoholic extract from the whole plant was mixed with water acidulated with sulphuric acid, and agitated first with petroleum ether, then with ether, and finally rendered alkaline and reagitated with ether.

The petroleum ether extract was dark-coloured, and soft, with a tea-like odour, and extremely and persistently bitter. It was mixed with 3 per cent. caustic soda solution and reagitated with petroleum ether, which removed the bitter principle contaminated with traces of oil and colouring matter. This extract gave the euphorbon colour reaction when treated with sulphuric and nitric acids. For the bitter neutral principle, we propose the name of *pseudochiratin.*

The acid ether extract contained green colouring matter, and was partly soluble in water with acid reaction, the solution giving a dirty bluish-green coloration with ferric chloride, slightly precipitating gelatine, but affording no reaction with cyanide of potassium.

The alkaline ether extract contained an alkaloidal principle, which, after purification, was obtained in white feathery crystals without any special taste. With Fröhde's reagent it gave a light yellowish-red coloration, changing to blue on heating; with concentrated nitric acid, yellowish. No reaction with dichromate of potassium and sulphuric acid.

BRIDELIA RETUSA, *Spreng.*

Fig.—*Baill. Etudes Gen. Euphorb., t.* 25, *f.* 25—34; *Bedd. Fl. Sylv., t.* 260; *Rheede, Hort. Mal. ii., t.* 16.

Hab.—Throughout the hotter parts of India. The bark.

Vernacular.—Khája, Kharaka, Lamkana (*Hind.*), Mulluvengai (*Tam.*), Dudhi-maddi, Kora-maddi (*Tel.*), A'sána, Phattar-phoda, Pálóhasan, Kántehasan, Hasáni (*Mar.*), A'sána, Gurige (*Can.*).

History, Uses, &c.—The astringent properties of the bark of this tree appear to be well known throughout India, as it is in general use for tanning leather. The wood is also much used, on account of its durability under water, for making well-curbs. In Western India the bark has a reputation as a lithontriptic, and is in general use as an astringent medicine. The tree is with or without thorns, according to situation and soil; the natives of Western India consider the thornless tree to be a distinct species, and call it Pálehasan, whilst the thorn-bearing tree is known to them as Kántehasan. When wounded, the bark exudes a blood-red juice, which stains the hands, and is very astringent.

Description.—The dry bark is externally of a light-brown colour, and has little fungous protuberances of dead suber; internally it is smooth and fibrous, of a cinnamon colour; taste purely astringent. If soaked in water it gives out much mucilage. The fibrous portion of the bark is very tough and strong. Sections placed under the microscope show the outer portion to be made up of thin-celled reddish parenchyma; in the inner portion there is much woody fibre and numerous vessels, the external surface of which is encrusted with large crystals arranged in regular columns

Chemical composition.—The bark afforded 41·7 per cent. of water extract, containing 39·9 parts of tannic acid. The tannic acid gave a greyish-green precipitate with plumbic acetate, and a blue-black colour with ferric chloride. The air-dried bark left 7·35 per cent. of ash on incineration. Although this is one of the most astringent barks in India, it does not appear to be known to, or used by, Europeans in the arts.

CLEISTANTHUS COLLINUS, *Benth.*

Fig.—*Beddome, Foresters' Man.*, 203, *t.* 23, *f.* 5 ; *Roxb. Cor. Pl. ii.*, 37, *t.* 169. *Syns.: Lebidieropsis orbicularis*, Müll-Arg., *Cluytia collina*, Roxb.

Hab.—Dry hills, in various parts of India, from Simla to Behar. Deccan Peninsula.

Vernacular.—Oduvan, Woodacha, Nachuta (*Tam.*), Kadishe (*Tel.*)., Kodasigina, Bodadaraga (*Can.*).

History, Uses, &c.—Under the name of *Andrachne Cadishaw*, Ainslie describes the poisonous properties of the nut of this tree, called *Wodoowunghai.* He says:—"About one pagoda weight, pounded, the Tamools believe to be sufficient to kill a man; the leaves and roots of the plant are also considered poisonous; the first, which no animal will touch, is, in conjunction with *Kadukai* (chebulic myrobalans), supposed to be a good application to foul ulcers. (*Mat. Ind.*, ii., 487.) Roxburgh remarks:—" The bark or outer crust of the capsule is reported to be exceedingly poisonous." (*Fl. Ind.*, iii., 733.)

Description.—Capsule $\frac{2}{3}$ of an inch in diameter, sessile, woody, rounded-3-gonous, top not lobed, dark-brown, shining and wrinkled when dry. Seeds $\frac{1}{6}$ of an inch in diameter, globose, chestnut-brown; albumen scanty.

Chemical composition.—The active principle of the plant does not appear to be an alkaloid, but, though its chemical nature has not yet been fully investigated, Mr. Newman, Assist. Chemical Examiner, Madras, has discovered that it gives a purple reaction with sulphuric acid, which disappears on oxidising with alkaline dichromate, and with nitric acid a blue colour changing to green; these tests serve to identify it with some degree of probability. An extract of the leaves and fruit acts as a violent gastro-intestinal irritant. (*Report, Madras Chem. Examiner,* 1885.)

Toxicology.—The Madras Chemical Examiner reported in 1885 that the poison had been found in two cases from South Arcot. "In one case a man being detected in an intrigue with his mother-in-law, her relations threatened to excommunicate her; whereupon both are supposed to have taken this poison and to have died very soon—from half an hour to an hour—after taking it. Both vomited. In the second case vomiting and purging were followed by recovery." In 1886 the same Chemical Examiner reported that the expressed juice of certain leaves (of *Oduvan*), the residue of which was sent for examination mixed with common salt, was supposed to have been taken by a man to cure itch. He suffered from vomiting and died in a few hours. In 1887 *Oduvan* was found, in a case from South Canara, in the stomach of a woman who poisoned herself when her husband was dying. She was suddenly seized with vomiting and died rapidly. In 1889 a woman was suspected of attempting suicide by poison; the leaves found in her possession were identified as those of this plant. In 1890 a pregnant woman died with symptoms of gastro-intestinal irritation, after taking an abortifacient; from her stomach was extracted a non-alkaloidal poison which gave reactions similar to those obtained from the extract of this plant.

The bark of **Flueggia Leucopyrus,** *Willd., Wight Ic., t.* 1875, a shrub of the Punjab Plain, the Deccan Peninsula, and Ceylon, is used both in Madras and Bombay as a fish-poison. The sweet, white berries do not appear to have any injurious properties, as they are eaten by children, who call them *Madh* (honey). The juice of the leaves is used to destroy worms in sores.

Chemical composition.—The bark contains 10 per cent. of a tannic acid, giving a violet-black colour with ferric chloride, and the mixture becomes red on the addition of ammonia. An alkaloid is also present, giving a purplish-red colour, afterwards turning to green, with Fröhde's reagent, and a violet colour with strong sulphuric acid and permanganate of potassium. The alkaloid is soluble in excess of alkalies. The infusion was somewhat frothy, but no sapogenin could be isolated from it after boiling with acid.

The bark of **Flueggia microcarpa,** *Blume, Wight Ic., t.* 1994, supplied by Mr. Hollingsworth as one of the South Indian fish-poisons, was in thin papery light-brown strips, and the powder had no odour and very little taste. Air-dried, it afforded 11·4 per cent. of mineral matter, and contained 8·9 per cent. of a tannin, giving a blue-black colour with ferric salts. The aqueous solution of the alcoholic extract furnished an alkaloidal principle similar in its reactions to that obtained from the bark of *F. Leucopyrus.*

Breynia rhamnoides, *Müll-Arg., Wight. Ic., t.* 1898, is a shrub or small tree of tropical India. According to Ainslie, it was brought to Dr. F. Hamilton, while in Behar, as a medicine of some note; the dried leaves are smoked like tobacco, in cases in which the uvula and tonsils are swelled. The bark is astringent.

Description.—Shrubby; young shoots angular; leaves alternate, short-petioled, spreading, broad-oval; exterior ones largest, below whitish, entire, half to three-quarters of an inch long; male flowers racemed from the lower axils; female flowers in the upper axils, solitary, short-peduncled, drooping; capsule size of a pea.

The nuts of **Putranjiva Roxburghii,** *Wall.,* in Sanskrit Putra-jiva or Putram-jiva, "that which makes the child live," are hung round the necks of children to keep them in good health. They are mentioned in the Nighantas as being also Garbha-kara, "productive of impregnation," and medicinal properties are attributed to them. The hard wrinkled nuts are generally worn only as a charm, but are sometimes given internally in colds on account of their supposed heating properties;

they are called Jivapota in Hindi, Kurupale in Tamil, Kabrajuvi in Telugu, Pongalam in Maliyali, and Jivanputra in Marathi.

JATROPHA GLANDULIFERA, *Roxb.*

Hab.—Deccan Peninsula, Bengal, Northern Circars, and sparingly elsewhere. The juice, root, and oil.

Vernacular.—Underbibi, Rán-erandi, Tadki-erandi (*Mar.*), Lál-bherenda (*Hind.*, *Beng.*), U'dalai (*Tam.*), Nela-amudamu (*Tel.*).

History, Uses, &c.—This plant appears to have been introduced into India, but it is not known from whence. Graham, in his *Catalogue of Bombay Plants*, published in 1839, says that in his time it was only to be found at Punderpore in the Deccan (a place much frequented by pilgrims, who come to visit the temple of Vithoba). There is a fabulous legend that it suddenly made its appearance at this place. The following is the story, for which we are indebted to Dr. Shantaram V. Kuntak of Punderpore :—" A certain cultivator was sowing his field on the 10th day of Áshádh, during the Áshádhi fair ; whilst thus engaged he was accosted by numbers of pilgrims who were passing by his field, on their way out of the town, to meet the palanquins of Dnyánoba, Námdeo and Tukáram, which are brought to Punderpore at this season from Paithan, Alandi, and Dehu. All the pilgrims asked him what he was sowing, until the man got tired of answering their questions ; in a short time another pilgrim came up and asked the same question,—the man, vexed beyond endurance, answered that hé was sowing नेट (membrum virile). It is said that this last pilgrim was the god Vithoba in disguise, who was going to meet the palanquins of his devotees, and that, annoyed at the cultivator's answer, he cursed him, saying, 'As you sow, so may you reap.' So when harvest time came, instead of the usual crop, the whole field was covered with this short thick-stemmed plant." Until within the last few years the field was called after the strange crop which it bore. It is now cultivated by a Mahometan, and produces a regular crop, but the Jatropha has not been entirely extirpated. Since Graham's time the plant has spread rapidly, and may be seen on waste ground in most parts of the island of Bombay, probably introduced along with the Castor seed of commerce. An oil is prepared from the seeds by roasting them in a perforated earthen vessel, fitted upon another vessel, into which, when the whole apparatus is heated in a pit filled with burning cowdung fuel, the oil drops. This oil is valued as an application to chronic ulcerations, sinuses, ringworm, &c. The root brayed with water is given to children suffering from abdominal enlargement; it purges, and is said to reduce glandular swellings. The juice of the plant is used in various parts of India as an escharotic to remove films from the eyes; it is greenish and viscid. The expressed oil of the seeds is yellow, has a specific gravity of 0·963, and solidifies at 5° C. (*J. Lepine, Jour. Phar.* [3], xl., 16.)

Description.—A small shrub, remarkable for the shining reddish-brown colour of its young foliage. The leaves are palmate, 3 to 5-cleft, panicles terminal, short, few-flowered; flowers small and red. The young branches and petioles of the leaves are thickly studded with sticky red glandular hairs. The capsules are 3-celled and 3-seeded, with an outer adherent fleshy epicarp, which dries up as the fruit ripens; when this takes place, the three triangular woody cells of which it is composed divide into six pieces suddenly with a sharp report, and the seeds are projected to a considerable distance; it is, therefore, necessary to gather the fruit before it is quite ripe and dry in a covered place. The seeds, including the strophiole, are three-tenths of an inch long and two-tenths broad; they are of a grey colour with two brown stripes on the dorsum, which is convex, the underside has two flat surfaces, divided by a central ridge. The kernel is without smell, and very oily; it has a sweet, nutty taste.

Chemical composition.—See *Jatropha Curcas.*

Jatropha nana, *Dalzell,* Kirkundi (*Mar.*), is a rare plant, found in waste, stony places near Poona. The juice is employed as a counter-irritant in the same manner as that of *J. glandulifera.*

Description.—A shrub 1 to 1½ foot high, all smooth; root tuberous, woody; root-bark thick and full of milky juice; stem round, smooth, very little branched; branches erect; leaves large for the size of the plant, sessile or shortly petioled, broadly ovate, entire or trilobate; lobes obtuse, central much the largest, 4 to 6 inches long and broad, pale beneath, 3-nerved, flowers panicled, terminal, few, 3 to 5 on each division; stipules minute; flower solitary, pedicelled, subtended by a subulate bract half its length; calyx leaves six, small, subulate; fruit obovoid, flattened at the top, slightly six-sulcated, as large as a nut. (*Dalzell.*)

JATROPHA CURCAS, *Linn.*

Fig.—*Jacq. Hort. Vind. iii., t.* 63; *A. Juss. Tent. Euphorb., t.* 11, p. 34 A. Physic Nut (*Eng.*), Medicinier (*Fr.*).

Hab.—Throughout India and Ceylon, naturalized.

Vernacular.—Bághrénda, Bágh-bherenda (*Hind., Beng.*), Moghli-erandi, Jepál (*Mar.*), Galamark (*Goa*), Káttámanakku (*Tam.*), Pépálam (*Tel.*), Káttá-vanakka (*Mal.*), Bettada-haralu (*Can.*), Jangli-arandi (*Guz.*).

History, Uses, &c.—This tree, introduced from America, is called by recent Sanskrit writers Kánana-eranda. Its seeds are sometimes used as a purgative and alterative by the Hindu physicians, but on account of their uncertain action they are not much esteemed. The oil is reckoned a valuable external application to itch, herpes, chronic rheumatism, and sores or wounds. Descourtilz states that the blacks of Rio Nunez saponify the oil with the ashes of the Papaya, and use the preparation to heal the wounds caused by circumcision.

The leaves are applied as a rubefacient and discutient, and a decoction of them is said to excite the secretion of milk in women. The viscid juice which flows from the stem upon incision is painted over cuts and wounds to check bleeding and promote healing; this it does by forming a thin film when dry like that produced by collodion. The author of the *Makhzan* also notices this use of the juice, and calls the plant *Bághréndeh.* Mr. Udoy Chund Dutt notices the hæmostatic properties of the juice, and Dr. Evers has injected a drachm of it into a varicose aneurism. He says :— "The result was astonishing; in twenty minutes time the pulsation was so faint that no non-professional person could have detected it; and by evening all pulsation had ceased, and a good firm clot had been produced. No ill-effects resulted from the injection." *J. Curcas* is said to have been introduced from Brazil by the Portuguese; it is now quite naturalized in many parts of India, and is a common hedge-plant in the Concans. The oil is used for burning. The juice, when dried in the sun, forms a bright reddish-brown, brittle substance like shell-lac, which may yet be put to some useful technical purpose. In Goa the root-bark is applied externally in rheumatism. In the Concan it is rubbed with a little asafœtida and given with buttermilk in dyspepsia and diarrhœa. The fresh stems are used as a tooth brush to stop bleeding from the gums. Roxburgh notices that the leaves warmed and rubbed with Castor oil are used by the natives as a suppurative.

Jatropha oil was formerly employed as a purgative by European physicians, under the names of *Oleum Ricini majoris* and *Oleum infernale.* At the present time it is much used for burning and for soap-making; also for adulterating olive oil, and seemingly for making Turkey-red oil. (*F. M. Horn, Zeit. Anal. Chem.*, xxvii., 163—165.

Description.—The young roots are soft, fleshy, and tapering, with a whity-brown scaly epidermis, and a few thin rootlets, bark yellowish-white internally, with a peculiar perfume like tuberose when freshly removed; wood white and very soft. On section the bark is seen to contain oil globules and very numerous conglomerate raphides; the vascular system is full of a yellowish viscid secretion; the wood is loaded with starch. The taste of the bark is acrid.

The fruit is ovoid, 6-striated, tricoccous and fleshy; when ripe it is of a pale greenish-yellow; as it gradually dries up it becomes black and partially dehiscent. There is one seed in each cell. The seeds (*Pignons d'Inde*) are of the same shape as Castor seeds, ¾ of an inch long and rather less than half an inch broad; the dorsal surface is arched and marked by a hardly perceptible ridge about the middle; the ventral surface has a well-marked ridge. At one end of the seed is a white scar. The testa is of a dull black and irregularly fissured all over, the fissures are yellowish. The kernel is enclosed in a thin, white membranous covering like that of the Castor seed.

The cotyledons are foliaceous, the radicle short and thick, the albumen copious and oily.

Chemical composition.—The kernels of the seeds of *J. Curcas* were found by Arnaudon and Ubaldini (*Kopp's Jahresber.*, 1858) to contain 7·2 per cent. water, 37·5 oil, 55·3 sugar, starch, albumin, casein, and inorganic matters. The kernels yielded 4·8 per cent. ash, and 4·2 per cent. nitrogen; the kernels and husks together 6 per cent. ash, and 2·9 per cent. nitrogen. The oil yielded by saponification, glycerine and an acid, which, as well as the unsaponified oil, produced caprylic alcohol by distillation with hydrate of potassium. Bouis had previously separated from it a liquid and solid fatty acid, and named the latter *Isoacetic Acid,* $C^{15}H^{30}O^{2}$. Cadet de Gassicourt (1824) found in the seeds an acrid resin.

F. M. Horn (*Zeit. Anal. Chem.*, xxvii., 163—165) states that the oil begins to crystallize at 9°, and is completely solid at 0°, at 15° its sp. gr. is 0 9192. It differs from Castor oil in its very sparing solubility in alcohol. It appears to saponify readily in the cold, but in reality forms only acid soaps; for complete saponification heat is required, and solid potash acts better than solution.

The fluid oleic acid obtained by Bouis may doubtless be regarded as ricinoleic acid.

According to Dr. H. Stillmark, the seeds contain *Ricin*, the poisonous principle of Castor seeds (see *Ricinus*).

Toxicology.—Christison (*Poisons*, p. 591) found from 12 to 15 drops to have generally the same effect as an ounce of Castor oil. Stillé and Maisch remark that it is more like Croton oil in its action. The acrid emetic principle resides chiefly in the embryo. It is stated that if the embryo is wholly removed, four or five of the seeds may be used as a purgative without producing either vomiting or griping. This opinion is supported by experiments upon dogs. A number of cases have occurred of poisoning by eating the seeds entire. In one case, a man who had eaten five of them soon complained of burning in the mouth and throat, and the whole abdomen felt distended and sore. In a few minutes vomiting occurred, and was repeated five times in the course of an hour, accompanied with active purging. The pain continued; the patient complained of feeling hot and giddy; he then became delirious, and afterwards insensible. On regaining consciousness several hours later his face was pale, his hands cool, the pulse 110 and weak. He recovered.

Several cases of accidental poisoning by the seeds have been recorded in India, and Chevers mentions one in which, in addition to the usual symptoms, muscular twitchings, deafness, impairment of sight, and loss of memory were observed.

Jatropha multifida, *Linn., Salisb. Hort. Paradis., t.* 91, the Medicinier d'Espagne of the French, and Coral tree of the English, is a common ornamental shrub in Indian gardens; it is not used medicinally, and only requires a brief notice on account of its seeds, which are powerfully purgative and emetic, sometimes giving rise to accidents when eaten by children. The plant is easily recognised by its multifid leaves and beautiful, red coral-like panicles of flowers. The fruit is bright-yellow when ripe, as large as a walnut, six-angled and three-celled, each cell contains a scabrous black seed resembling that of *J. Curcas*. We have found limejuice and stimulants to be the best remedies in cases of poisoning by the seeds. The plant appears to have been introduced by the Portuguese from Brazil, where the oil of the seeds is known as *Pinhoen oil,* and is used as an emetic.

At Martinique it is called *Ipeca pays,* on account of its being used in a similar manner; one seed acts as an emeto-cathartic. Corre and Lejanne state that the Creole women used to prepare an "*Orange purgative*" by macerating an orange in the oil for a month, and then drying it; this orange, when rubbed in the hands and smelt, was believed to act as a purgative.

According to Soubeiran, the oil of these seeds is very similar to, if not identical with, that of *J. Curcas.*

Toxicology.—Cases of accidental poisoning by the fruits have been recorded in India, chiefly among children who have been attracted by their tempting colour. The symptoms have been similar to those produced by *J. Curcas.*

ALEURITES MOLUCCANA, *Willd.*

Fig.—*Lamk. Ill., t.* 791; *A. Juss. Tent. Euphorb., t.* 12; *Rumph. Amb. ii., t.* 58. Candleberry tree (*Eng.*), Aleurit des Molluques (*Fr.*).

Hab.—Pacific Islands. Cultivated in India. The oil.

Vernacular.—Jangli-akhrot (*Hind.*), Rán-akhrot, Japhala (*Mar.*), Jangli-akhroda (*Guz.*), Náttu-akhrotu (*Tam., Tel.*), Nát-akrodu (*Can.*).

History, Uses, &c.—Rumphius (iii., 12) states that the Javanese and Macassars make candles of the seeds of this tree, either pounded and mixed with cocoanut or cotton seeds, or simply strung upon a piece of split bamboo; they also eat the seeds raw and roasted. In the South of India, where the tree is much cultivated, the seeds are known as Indian walnuts. When pressed they yield a large proportion of oil, used as a drying oil for paint, and known as country walnut oil, bankoul-nut oil and artist's oil. In Ceylon it is called *Kekuni oil,* and in the Sandwich Islands, where it is used as a mordant for their vegetable dyes, *Kakui oil.* In these islands alone about 10,000 gallons are annually produced. It has been imported into Europe for soap-making, but not to any considerable extent, and fetches about £20 per imperial ton. The oil is stated to possess powerful desiccative properties. The cake, after the oil has been expressed, is esteemed as a manure. The root of the tree affords a brown dye, which is used by the Sandwich Islanders for their native cloths. In India the oil is used as a dressing for ulcers; its medicinal properties were examined by Dr. O. Rorke (*Ann. de Thérap.*, 1859, p. 117), who found that in doses varying from 1 to 2 ounces it acted as a mild and sure purgative, producing in from three to six hours, after ingestion, free bilious evacuations, its operation being unattended either by nausea, colic or other ill-effects. (*Phar. of India*, p. 203.) From more recent experiments it appears that half an ounce of the oil is a sufficient aperient. MM. Corre and Lejanne (*Résumé de le Mat. Med. et Tox. Coloniale*) remark:—"There is no doubt that the properties of this oil differ when the oil is prepared in different ways." When cold drawn from the fresh nuts, Heckel, who used it at the Military Hospital at Nouméa, found that it was only purgative in 80 gram doses, that is to say, it simply acted as a fatty oil; he found that the drastic resinous constituents remained in the oil-cake. M. Jugant, at Nosi-Bé, found that the oil extracted by the hot process acted freely as a purgative in 40 gram doses. Many observations were made in the Military Hospital with the result that the oil was found to operate in from 1 to 3½ hours. Dr. Grasourdy considers the oil to equal castor oil in purgative properties. The oil, if intended to be used as a purgative, should be extracted by pressure between hot plates.

Description.—A tree of considerable magnitude, attaining the height of 30 to 40 feet. The leaves are alternate, four to eight inches long, stalked and without stipules, either oval-acute and entire, or from three to five-lobed, and like all the young parts covered with a whitish starry pubescence. The flowers are small and white, growing in clusters at the apex of the branches, the males and females together in the same cluster, the former being the most numerous. The fruit is 2-celled, fleshy, roundish, and, when ripe, of an olive colour, its greatest diameter about 2½ inches; each cell contains one ovoid somewhat flattened nut, the shell of which is very hard and thick; the kernel is conform to the nut, white and oily.

Chemical composition.—The nuts have been examined by Nallino (*Gaz. Chim. Ital.*, ii., 257), who found the average weight of the husks to be 6·5 grams, of the almonds 3·3 grams. Composition of husks: water, 3·71; organic matter, 89·90; mineral matter, 6·39. Composition of almonds: water, 5·25; fat (extracted by carbon sulphide), 62·97; cellulose and other organic matters, 28·99; mineral matter, 2·79. Composition of the ash of the almond: lime, 18·69; magnesia, 6·01; potash, 11·33; phosphoric anhydride, 29·30. The fatty matter extracted from the almonds by carbon sulphide at ordinary temperatures forms a transparent, amber-yellow, syrupy liquid. When cooled to —10°, it becomes viscous, but neither loses its transparency nor changes colour. According to Brannt, the oil has a specific gravity of 1·940 at 59°F. It consists of an olein resembling linolein, besides myristin, palmatin and stearin. The purgative principle is probably an acrid resin. The oil-cake from Indian and Tahitian seeds has respectively the following percentage composition:—

	Indian.	Tahitian.
Oil	8·93	9·20
Organic matter	74·04	74·24
Ash	8·96	9·36
Water	7·07	7·20

The albuminoids were respectively equal to 52 and 51·7 per cent. (*Brannt.*).

An allied oil (from *Aleurites cordata*) has been examined by Mr. R. H. Davies (*Pharm. Journ.* [3] xv., 636). It is the wood oil of China, and has remarkable drying properties. The specific gravity at 15°·5C. is ·940, and is unaffected by a temperature of —13°C. It required 211 grams of caustic potash to convert one thousand grams of oil into potash soap. The fatty acids amounted to 94·1 per cent., melting at 39°, containing some white crystalline plates melting at 67°.

CROTON TIGLIUM, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 239; *Rheede, Hort. Mal. ii.*, *t.* 33. Purging Croton (*Eng.*), Croton cathartique (*Fr.*).

Hab.—China. Cultivated in India. The seeds and oil.

Vernacular.—Jaypál, Jamálgota (*Hind.*), Jaypál (*Beng.*), Nipálo (*Guz.*), Jamálgota (*Mar.*), Nepála (*Can.*, *Tel.*), Nerválam (*Tam.*), Nirválam (*Mal.*), Kanako (*Burm.*).

History, Uses, &c.—Croton seeds were not known to the ancient Hindu physicians; in recent Sanskrit works they are noticed under the names of Jayapála, Tittiriphala and Kanakaphala, and are described as heavy, mucilaginous and purgative, useful in fever, constipation, enlargements of the abdominal viscera, ascites, anasarca, cough, &c., expelling bile and phlegm. They are directed to be boiled in milk, the outer skin and embryo having been removed, to fit them for internal administration. The following prescription from the Bhavaprakasa may be taken as an example :—

Mahanaracha rasa.—Take Chebulic myrobalans, pulp of *Cassia fistula*, Emblic myrobalans, root of *Baliospermum axillare* (danti), *Picrorhiza Kurrooa* (tikta), milky juice of *Euphorbia neriifolia* (snuhi), root of *Ipomœa Turpethum* (trivrit), and the tubers of *Cyperus rotundus* (mustaka), each one tolá : pound them to a coarse powder, and boil in four seers of water till the latter is reduced to one-eighth. Then take a tolá of husked Croton seeds, tie them in a piece of thin cloth, and boil them in the abovementioned decoction, till the latter is reduced to the consistence of a fluid extract. To this extract add a powder composed of eight parts of purified Croton seeds, three parts of ginger, and two of black pepper, mercury, and sulphur in quantity sufficient to make a pill mass; rub them together for twelve hours, and make into two-grain pills. These are given with cold water in tympanitis, colic, ascites, &c., as a drastic purgative. After the operation of this medicine, rice should be given with curdled milk and sugar.

The Indian names for Croton seeds lead us to suppose that they were first introduced into the country through Nepal. Under the name of Dand they were known to the Persians at a very early date, and were doubtless introduced into that country from China by the Caravan route through Central Asia. The Arabs retained the Persian name, but also called them Hab-el-khatái, "Cathay seeds," and Hab-el-salátín, "Sultans' seeds." Ibn Sina describes them under the name of Dand-el-sini, "China Dand," and also mentions an Indian Dand of smaller size (probably Baliospermum seeds). Ainslie states that Croton seeds were known to the Arabs under the name of *Fill*, but this is incorrect, as may be seen by referring to Ibn Sina, who describes Fil as an Indian drug having the properties of the Mandrake. Mahometan physicians describe the seeds as detergent, a purgative of phlegm, black bile, and adust humors; and recommend their use in dropsy, calculus, gout, and other diseases arising from cold humors. On account of its irritant action upon the fauces, the seed, after having been boiled in milk, is to be crushed and enclosed in a raisin for administration. The author of the *Makhzan* remarks that the Hindus give small doses with fresh ginger tea, to children, as a remedy for whooping cough. He also notices its irritant action upon the skin, and its use as an external application to tumours, &c.; should excessive purging occur, he directs limejuice to be administered. The envelopes of the seed and plumule must always be rejected. *Croton Tiglium* was first described by Christoval Acosta in 1578, afterwards by Rheede in 1679, and Rumphius in 1743. In 1812, Drs. White and Marshall brought the use of the seeds as a purgative to the notice of Europeans in India. The former gentleman gives the following directions for their administration, which he received from a learned Parsee Vaidia of Surat:—"After having removed the shells from the seeds, tie the kernels in a small piece of cloth, like a bag; then put this into as much cowdung water as will cover the bag, and let it boil; secondly, when boiled, split the kernels in two and take a small leaf from them, which is said to be poisonous; and thirdly, pound the whole into a mass, to which add two parts of Katha (catechu), and divide into pills of two grains each, two of which are sufficient for one dose." The addition of the Katha is said to correct the acrimony of the drug, and to prevent any griping of the bowels.

Ainslie (*Mat. Indica,* Vol. I., p. 105) notices the use of the expressed oil (nervalum unnay) by the Tamils as an external application in rheumatic affections, but it does not appear to have been used for internal administration until the year 1821. (*Confer. London Medical Depository for January* 1822.)

In modern European medicine, croton oil, more or less diluted, is used externally as a counter-irritant, and causes an abundant pustular eruption. This effect is increased by the addition of an alkali to the liniment. Internally it is given in doses of ½ to 1 minim as a purgative, and is particularly valuable in those cases in which the condition of the patient prevents him from swallowing; it may be placed on the back of the tongue. The oil has also been used with success as an anthelmintic. In modern pharmacy its chief consumption is in the preparation of castor oil capsules.

Description.—Croton seeds (*graines de Tilly*) are oblong, about half an inch long, and not quite ⅔ of an inch broad. The dorsal and ventral surfaces are arched, the former more prominently than the latter. The testa is black, but covered for the most part by a thin cinnamon-coloured membrane; it is thin and brittle, and contains an abundant oily albumen enclosed in a delicate white membrane (endopleura). Between the two halves of the albumen are two foliaceous cotyledons, and a short thick radicle. The structure of these parts closely resembles that of the albumen and embryo of *Ricinus communis.*

Chemical composition.—The fats present in croton oil are glycerides of stearic, palmitic, myristic, and lauric acids, and of several volatile acids of the same series, like acetic, butyric, and valerianic acid; also the volatile *tiglinic acid*, $C^5H^8O^2$, which was recognized by Geuther and Frölich (1870), but had previously been observed by Schlippe (1858), who considered it to be identical with angelicic acid. However, it melts at 64° C., boils at 198·5° C., and is identical with Frankland and Duppa's methylcrotonic acid. In the fraction boiling above the temperature named, capronic, œnanthylic, or similar acids are probably present. They did not succeed in obtaining from croton oil an acid having the composition of Schlippe's *crotonic acid*, $C^4H^6O^2$. E. Schmitt (1879) corroborated these statements, and found among the volatile acids also formic acid. Schlippe's *crotonol*, $C^{18}H^{28}O^4$, has likewise not been obtained by other chemists; it was stated to be a yellowish viscid mass of a faint odour, and to be the rubefacient principle of croton oil. The drastic rubefacient properties, according to Buchheim (1873), reside in *crotonoleic acid*, which is present in the free state and as glyceride, and which seems to be related to ricinoleic acid, since, like the latter, it yields with nitric acid œnanthic acid, and on the distillation of its sodium salt gives œnanthol. (*Stillé and Maisch.*)

H. Senier (*Pharm. Journ.* [3], XIV., 446, 447) has shown that when alcohol (sp. gr. ·794—·800) is mixed in equal volumes with English pressed croton oil, perfect solution takes place, the mixture being permanent at all ordinary temperatures, and this is equally true when any less quantity of alcohol is used; when, however, the proportion of alcohol to croton oil becomes as seven volumes to six, or any larger proportion of alcohol, then a part of the croton oil separates. This part varies in quantity in the case of different samples of oil. That part of the croton oil which separates when the alcohol is in excess is afterwards insoluble in any proportion of alcohol. But that portion of the oil dissolved by alcohol is, when separated, soluble in all proportions. The author has shown that the part of croton oil soluble in alcohol contains the vesicating principle, while the portion insoluble in alcohol is entirely non-vesicating. He also shows that the purgative properties of croton oil reside entirely in this insoluble, non-vesicating part. The author has endeavoured to ascertain to what constituent of the soluble portion of the oil the vesicating properties are due, and has traced these properties to the non-volatile fatty acids, chiefly to those which have the lowest melting points, are least readily saponified by alkalies, and are first liberated when the alkali soap is decomposed by acids. He attributes the purgative action not to the free acids, but to the combination in which they exist in the oil.

These conclusions not appearing satisfactory to Professor Kobert, the investigation was taken up by Herr von Hirschheydt, a pupil in the University of Dorpat. Upon the basis of the results obtained, Professor Kobert now (*Chem. Zeit.*, April 6, 1887, p. 416) attributes the activity of croton oil, both as a vesicant and as a purgative, to crotonoleic acid, not to be confounded with crotonic acid, but an acid discovered by Buchheim in 1873, to which a formula has not yet been assigned. This crotonoleic acid is said to occur in croton oil both in the free state, in which it is freely soluble in alcohol, and in combination as a glyceride. The glyceride does not possess poisonous properties, but the free acid acts as a powerful irritant to the skin and the intestines (purgative). According to Professor Kobert, the crotonolglyceride is attacked and split up like other glycerides by the ferments of the juices of the stomach, and the crotonoleic acid being set free then exercises its purgative influence. A similar result may be obtained by administering crotonoleic acid as a pill enclosed in keratin. Kobert is not of opinion, however, that the solubility of croton oil is dependent upon the proportion of crotonoleic acid it contains, but considers it to be connected with the age of the oil. Crotonoleic acid may be prepared by treating the portion of croton oil soluble in alcohol with a hot saturated solution of baryta in a water-bath, washing the stiff white paste that forms with cold distilled water to remove excess of baryta, and barium compounds with acetic, butyric and tiglinic acid, removing by heat traces of water, and repeatedly treating with ether, which only takes up the barium oleate and crotonoleate. The crotonoleate is separated by dissolving it out in alcohol, decomposed carefully with sulphuric acid, and the solution containing the free acid evaporated. (*Pharm. Journ.*, April 30th, 1887.) According to Dr. H. Stillmark, croton seeds contain *Ricin*, the poisonous principle of castor seeds. (*See Ricinus.*)

Toxicology.—The seeds are said to be used in Java for killing fish, and the oil has been shown to have the same effect upon the carnivora as upon man. When eaten, the seeds cause nausea and eructation, followed by flatulent distension of the abdomen, colic and diarrhœa. A single seed is reported to have proved fatal. The oil, in the dose of 1 drop, occasions more or less of an acrid and burning sensation in the fauces and œsophagus, a sense of warmth in the stomach, nausea, and sometimes vomiting. In an hour or two, some gurgling or slight colic is perceived in the bowels, followed somewhat suddenly by a watery stool with tenesmus, and heat about the anus. Within 24 hours eight or ten more stools follow, and there is but little general disturbance of the economy, except considerable weakness. Sometimes, instead of producing evacuations, the oil causes epigastric uneasiness and oppression, palpitation of the heart, headache, feverishness, perspiration, and sleep. It would appear that the acrid principle of the oil is not the sole cause of its cathartic operation, for even after being thoroughly washed with alcohol and rendered mild to the taste, as well as incapable of pustulating the skin, it is still strongly purgative. (*Stillé and Maisch.*) No cases of poisoning by croton seeds or oil in India appear to have been recorded.

During the expression of croton oil in India, the workmen, who are naked, with the exception of a cloth round the loins, have been observed to suffer from redness and irritation of the skin, evidently produced by some volatile constituent of the oil.

CROTON OBLONGIFOLUS, *Roxb.*

Hab.—Bengal, Silhet, Behar, Central India, Deccan Peninsula, Burma, and Ceylon. The root-bark, leaves, and fruit.

Vernacular.—Chucka, Barágach (*Beng.*), Arjuna (*Hind.*), Kote, Putol (*Mal.*), Bhutan-kusam (*Tel.*), Ghanasura (*Mar.*), Gote (*Santal*), Kurti, Konya, Kuli, Poter (*Kol.*), Gonsurong (*Goa*).

History, Uses, &c.—Brandis has noticed the use of the bark, leaves and fruit of this plant in native medicine, and Dr. Irvine the use of the seeds as a purgative. From the *Dict. Econ. Prod. of India* we learn that the Santals use the bark and root as a purgative and alterative. We have been unable to find any notice of the drug in native works on Indian Materia Medica. Roxburgh, though he describes the tree as common in forests near Calcutta, is silent upon the subject. Dalzell and Gibson, in the *Bombay Flora* (p. 231), remark that "the plant is used medicinally by the natives to reduce swellings." The author of the *Mat. Med. of West. India* remarks:—"When on a visit to Goa in 1876, my attention was drawn by the native doctors to the root-bark of a small tree as being one of the most valuable medicines they possessed; this plant, unknown to me at the time, proved on subsequent investigation to be *C. oblongifolius*. The Goanese and inhabitants of the Southern Concan administer the bark in chronic enlargements of the liver and in remittent fever. In the former disease it is both taken internally and applied externally. As an application to sprains, bruises, rheumatic swellings, &c., it is in great request. In large doses it is said to be purgative." Flückiger and Hanbury (*Pharmacographia*, p. 510) state that the seeds are said to be sometimes substituted for those of *C. Tiglium*. The tree is rare in the Bombay Presidency, and has only been found in the Southern Concan, where it has a reputation as a remedy in snake-bites. In Goa it is more common.

Description.—Trunk straight; bark ash-coloured, and pretty smooth; leaves petioled, alternate, and thickly set about the ends of the branchlets, spreading or drooping, oblong, serrate, obtuse-pointed, very smooth on both sides, from six to twelve inches long, petioles round and smooth, with a lateral gland on each side of their apices; stipules small, caducous;

racemes terminal, generally solitary, erect, shorter than the leaves; flowers solitary, a few female ones mixed with many male ones, small, of a pale yellowish-green; bracts 3-fold, one-flowered, on the inside of each of the small lateral bracts is a round permanent gland, as in *Sesamum indicum*; male calyx deeply 5-cleft, petals six, smaller than the calyx, very woolly; filaments twelve, distinct, nine in the circumference and three in the centre, woolly towards the base; female calyx and corol as in the male; stamens none; germ globular; styles three, each divided into two very long, variously bent segments; capsules globular, fleshy, six-furrowed, tricoccous. (*Roxb.*)

The root is twisted, often somewhat flattened, bark thickish, externally light-brown and scaly, internally yellowish, mottled with brown, substance compact and resinous, odour highly aromatic, taste peppery and camphoraceous. Wood white, soft.

Microscopic structure.—Sections of the bark show that the epidermis consists of about five rows of elongated cells placed horizontally; their walls are much thickened by a dark-brown deposit, which produces a patchwork appearance. The parenchyma is loaded with large globular or oval highly refractive bodies of a yellowish colour; there are also numerous dark purplish-brown particles, which are sometimes single but usually arranged in irregular concentric rows; they appear to be due to a deposit in the vascular system of a resinous nature.

Chemical composition.—The fresh root-bark was contused, and exhausted with warm 80 per cent. alcohol. The tincture was of a red colour. The alcoholic extract was mixed with water and agitated with petroleum ether, when reddish flocks separated. The solution was acid in reaction. The petroleum ether solution left on spontaneous evaporation a transparent viscid yellow residue, possessing a camphoraceous and pepper-like odour and taste. With the exception of some white flocks, the extract was soluble in cold alcohol with acid reaction; the solution afforded no coloration with ferric chloride.

The turbid aqueous solution, after separation of petroleum ether, was agitated with ether, without solution of the reddish flocks referred to as having separated on agitation with petroleum ether. The ether was separated from the turbid aqueous layer, and agitated with dilute sulphuric acid to separate any alkaloidal principle. The acid aqueous solution was then rendered alkaline and reagitated with ether. The ethereal solution left on spontaneous evaporation a slightly greenish transparent varnish-like residue, partly soluble in dilute sulphuric acid, the solution affording marked alkaloidal reactions. With Fröhde's reagent a dirty red to purple colour was observed, but no other special colour reactions were noted.

The original ethereal solution, after the agitation with sulphuric acid, left on spontaneous evaporation a brittle, transparent, yellow residue, soluble in alcohol with strong acid reaction, but affording no colour reaction with ferric salts. By the action of dilute aqueous caustic soda a part of the ethereal extract was dissolved with a deep port-wine red coloration. The portion insoluble in the alkaline solution was yellowish. The alkaline solution, on the addition of dilute acids, afforded yellow flocks, nearly wholly soluble in ether, and leaving a transparent yellow varnish on spontaneous evaporation, with a slightly bitter taste and acid reaction in alcoholic solution. The reddish flocks insoluble in petroleum and ordinary ether were separated from the original aqueous solution, and, when dry, formed a dirty reddish friable mass without taste or odour. In dilute alcohol this principle was soluble with acid reaction, the solution being of a port-wine colour, and possessing a slight spicy odour and taste. The solution, after being neutralized with ammonia, which deepened the tint, afforded a dirty plum-coloured precipitate with acetate of lead. To the original now clear aqueous solution of the alcohol extractive carbonate of soda was added, which caused a carmine-coloured precipitate, and the liquid agitated with ether, which failed to dissolve the precipitate. The ethereal solution left on evaporation a trace of residue, partly soluble in dilute suphuric acid, the acid solution reacting with alkaloidal reagents. With Fröhde's reagent the colour was dirty red to purple, and, like the principle first extracted by ether from the acid aqueous solution, yielding no other special colour reactions. The carmine flocks precipitated by the alkali, and which were insoluble in ether, were separated by filtration, the filtrate being of a logwood colour, and washed with cold water in which they were slightly soluble: on ignition an alkaline ash was left. By dilute acids the carmine precipitate was changed to salmon-yellow, the original colour being restored by alkalies. An aqueous solution gave a carmine-coloured precipitate with acetate of lead.

The original aqueous alkaline solution was lastly acidified with dilute sulphuric acid, which caused the separation of salmon-coloured flocks, and agitated with amylic alcohol. The amylic alcohol extract was reddish-yellow, becoming of a deep carmine hue with alkalies, and afforded a carmine precipitate with acetate of lead; acids destroyed the colour and caused a precipitate of salmon-coloured flocks practically insoluble in ether. By heating with zinc dust, the dried principles, which gave coloured precipitates with alkalies and acetate of lead, afforded no crystalline sublimates. The freshly contused root-bark afforded on steam distillation a small amount of a colourless volatile oil possessing a marked camphoraceous and pepper-like odour and taste.

In this investigation the principles which afforded coloured precipitates with alkalies were the most interesting, and these principles would appear to have been acids. It will be noted that the original aqueous solution of the alcoholic extract was not treated with any foreign acid prior to agitation with petroleum and ordinary ether. The flocks which separated during agitation with petroleum ether, and which were insoluble in ether, gave from an alcoholic solution a different coloured precipitate with acetate of lead, from the acids which were subsequently precipitated when the aqueous solution of the extract was rendered alkaline and agitated with ether, and when the alkaline solution was subsequently acidified before agitation with amylic alcohol. The last two acids referred to were, we consider, identical. The sodium salt of the acid was only slightly soluble in water, while the free acid was at best only slightly soluble in ether. The addition of sodic carbonate hence caused the precipitation of the greater part of the sodium salt, a small amount only remaining in solution. The subsequent addition of sulphuric acid decomposed the sodium salt in solution, with separation of the free acid in salmon-coloured flocks. As regards the identity of this acid with the one originally separated on agitation with petroleum ether, and ether, though the colour of the lead salt was different, it might have been due to the presence of foreign matters, and we are inclined to the view that these acid principles were similar. The alkaloidal principle from the first ether extract, and that obtained from the alkaline ether, were also probably identical.

ACALYPHA INDICA, *Linn.*

Fig.—*Wight Ic., t.* 877; *Rheede, Hort. Mal. x., t.* 81.

Hab.—Hotter parts of India.

ACALYPHA PANICULATA, *Miquel.*

Fig.—*Rheede, Hort. Mal. x., t.* 83.

Hab.—Deccan Peninsula. The herb.

Vernacular.—Kuppi, Khokali (*Hind., Mar.*), Dádaro (*Guz.*), Muktajuri, Shwet-basanta (*Beng.*), Kuppaimeni (*Tam.*), Kuppai-chettu, Murkanda-chettu, Puppanti, Harita-manjari (*Tel.*), Chálmári, Kuppi (*Can.*), Kuppa-mani (*Mal.*)

History, Uses, &c.—The medicinal properties of these plants are well known in India, but we have been unable to find any notice of them in the standard Sanskrit medical works.

Ainslie gives Aritamunjayrie as the Sanskrit name, which is evidently meant for Harita-manjari, "a plant with clusters of green flowers," a very appropriate name. Rheede describes two species of *Acalypha*, Cupameni (*A. indica*), and Wélia-cupameni (*A. paniculata*); he gives Manjara-sejári as the brahminical name of the first, and states that the juice, made into a liniment with oil, is used in rheumatism and venereal pains and eruptions, and, with the addition of lime, in skin diseases; that the root rubbed down with hot water is given as a cathartic; the leaves with water as a laxative, and in decoction to relieve the pain of earache. Of the second, he says that when rubbed down in rice-water and applied locally, it relieves pain, and that the juice with sesamum oil is useful in erysipelatous inflammation, hæmorrhoids, and the pain in the belly called by the Malabars *Guinao*. Ainslie says of *A. indica*:—"The root, leaves and tender shoots are all used in medicine by the Hindus. The powder of the dry leaves is given to children in worm cases, also a decoction of them with the addition of a little garlic. The juice of the same part of the plant, together with that of the tender shoots, is occasionally mixed with a small portion of margosa oil, and rubbed on the tongues of infants for the purpose of sickening them and clearing their stomachs of viscid phlegm. The hakims prescribe the Koopamaynee in consumption." In the *Pharmacopœia of India* (p. 205), the following reference to this plant by Dr. G. Bidie, of Madras, will be found:—"The expressed juice of the leaves is in great repute, wherever the plant grows, as an emetic for children, and is safe, certain, and speedy in its action. Like Ipecacuanha, it seems to have little tendency to act on the bowels or depress the vital powers, and it decidedly increases the secretion of the pulmonary organs. The dose of the expressed juice for an infant is a teaspoonful." Dr. Æ. Ross speaks highly of its use as an expectorant, ranking it in this respect with senega; he found it specially useful in the bronchitis of children. The purgative action of the root noticed by Rheede is confirmed by Dr. H. E. Busteed, who has used it as a laxative for children. In Bombay the plant has a reputation as an expectorant, hence the native name Khoklí (cough). Brigade-Surgeon Langley, in a communication to Dr. Watt, *Dict. Econ. Prod. Ind.*, Vol. I., writes:—"This plant is called in Canara *Chálmári* as well as Kuppi. The natives use it in congestive headaches: a piece of cotton is saturated with the expressed juice and inserted into each nostril; this relieves the head symptoms by causing hæmorrhage from the nose. The powder of the dry leaves is used in bedsores and wounds attacked by worms. In asthma and bronchitis I have employed it with benefit both for children and adults." Dr. Langley recommends a tincture of the fresh herb made with spirits of ether (3 ozs. to one pint), dose 20 to 60 minims, frequently repeated during the day, in honey; it acts as an expectorant and nauseant; in large doses it is emetic.

Description.—*A. indica.*—Stem erect, from 1 to 2 feet high, branchy, round, smooth; leaves scattered, petioled, ovate-cordate, 3-nerved, serrate, smooth, about 2 inches long and 1½ broad; petioles as long as the leaves; stipules small, subulate; spikes axillary, generally single, peduncled, erect, as long as the leaves, many-flowered, crowned with a body in the form of a cross, the base of which is surrounded with a 3-leaved calyx, the arms of the cross are tubular, with their mouths fringed, from the base of the cross on one side issues a style-like thread, with a fringed stigma, the body of the cross contains an ovate seed like substance; male flowers numerous, crowded round the upper part of the spike, calyx 4-leaved, leaflets cordate, filaments minute, numerous; female flowers below the male, remote; involucre cup-formed, with an opening on the inner side, striated, smooth, toothed, from 2 to 4-flowered; calyx 3-leaved. (*Roxb.*).

A. paniculata is a pubescent under-shrub or herb, with long-petioled ovate-acuminate leaves which are coarsely and equally serrated. The male flowers are in axillary, filiform spikes, and the female in axillary and terminal racemes or panicles; the bracts are minute and not enlarged in fruit. Capsule 1¼ inch in diameter, 3-lobed, glandular, styles 3—7-partite.

Chemical composition.—The whole plant of *A. Indica* was dried at a low temperature, reduced to powder, and exhausted with 80 per cent. alcohol. The alcoholic extract was mixed with water, acidulated with sulphuric acid, and agitated with petroleum ether, and ether; the solution was then rendered alkaline and agitated with ether. During agitation with petroleum ether, a quantity of dark matter separated, which was partly soluble in ether, and in alkalies, and contained much colouring matter. The petroleum ether extract was dark and viscid, and had an aromatic odour, but did not yield any crystalline deposit on standing: in absolute alcohol it was soluble, and on spontaneous evaporation some yellow matter separated, which was destitute of crystalline structure on microscopic examination. The alcoholic solution had no special taste. The ether extract was yellow, and had an aromatic somewhat tea-like odour, and on standing became indistinctly crystalline. In warm water a portion dissolved, the solution possessing a strong acid reaction, and affording a dirty reddish coloration with ferric chloride: it did not precipitate gelatine, and gave no reaction with cyanide of potassium. The portion insoluble in water was dissolved by ammonia, affording a deep yellow coloured solution with a somewhat camphoraceous odour, the addition of acids causing the precipitation of whitish flocks.

The ether extract obtained from the original aqueous solution, after it had been rendered alkaline, contained a well-marked alkaloidal principle, which after purification afforded the following reactions: with Fröhde's reagent pinkish in the cold, dirty blue on warming; with sulphuric acid yellowish-red; no reaction with sulphuric acid and potassium bichromate; no reaction with ferric chloride; with nitric acid a yellow coloration; it was not precipitated by chromate of potash from an aqueous solution acidulated with sulphuric acid; taste harsh, without bitterness. We propose provisionally to call this principle *Acalyphine.*

Ainslie notices the use of **A. fruticosa**, Forsk., as a stomachic and alterative, an infusion of the leaves being used. (*Mat. Ind.*, ii. 388.)

TREWIA NUDIFLORA, *Linn.*

Fig.—*Wight Ic.*, *t.* 1870—1; *Baill. Étud. Gen. Euphorb.*, *t.* 18; *f.* 18—23; *Rheede, Hort. Mal. i.*, *t.* 42.

Hab.—Hotter parts of India. The root.

Vernacular.—Pindára, Túmri, Bhilaura (*Hind.*), Pitáli (*Beng.*), Pitári, Sivani (*Mar.*), Kát-kumbla (*Can.*), Kánchi (*Mal.*).

History, Uses, &c.—This tree bears the Sanskrit names of Pindára, Karaháta, and Kurangaka. It is described in the Nighantas as sweet and cooling, useful for the removal of swellings, bile and phlegm; the root is prescribed in gouty or rheumatic affections. Rheede describes the plant under the name of *Canschi,* and states that the root in decoction is used to relieve flatulence, and is applied locally in gout.

Description.—The root has a thickish bark, which is of a light-brown colour externally, nearly smooth, and studded here and there with a few small lenticular corky worts. On rubbing off the thin brown suberous layer a dull-red surface is exposed. The bark is fibrous and tough, and has a subaromatic, astringent and slightly bitter taste. The wood is white and soft.

Chemical composition.—The fresh root-bark was contused and exhausted with 80 per cent. alcohol; the alcoholic extract mixed with water acidulated with sulphuric acid, and agitated successively with petroleum ether, and ether; then rendered alkaline with sodic carbonate and agitated first with ether and lastly with amylic alcohol.

During agitation with petroleum ether a large amount of resinous matter separated. The petroleum ether extract contained a large amount of colouring matter and had a persistent bitter taste. By agitation with water acidulated with sulphuric acid and ether, it was separated into two portions, a portion soluble in ether, which contained the greater part of the colouring matter, and some fat; while the aqueous acid solution held in suspension yellowish flocks consisting of a neutral resinous principle.

The acid ether extract was small in amount, partly soluble in water with acid reaction; the solution giving a blue-black coloration with ferric chloride, and precipitating gelatine, but giving no reaction with potassium cyanide. On adding ammonia to the ether extract, a yellow to brown sherry colour was produced. The ammoniacal solution was agitated with ether, which removed a small amount of whitish resinous matter, insoluble in water and containing no alkaloidal principle. The ammoniacal solution contained resinous matter.

The alkaline ether extract contained traces of an alkaloid, which, after purification, gave a very faint-yellow coloration with Fröhde's reagent in the cold, the colour becoming faintly greenish on warming; concentrated nitric acid gave a slight yellow coloration.

The amylic alcohol extract contained some resinous matter, and an alkaloidal principle in larger amount than was present in the ether extract, but which we consider to be identical.

The resinous matter which separated on originally shaking the alcoholic extract with petroleum ether, and which was insoluble in it, also failed to dissolve in ether; it was also insoluble in aqueous sodic carbonate, and had the properties of phlobaphene.

MALLOTUS PHILLIPPINENSIS, *Müll-Arg.*

Fig.—*Bentl. and Trim.*, *t.* 236; *Bedd. Fl. Sylv.*, *t.* 289; *Roxb. Cor. Pl. ii.*, *t.* 168; *Rheede, Hort. Mal. v.*, 21, 24.

Hab.—Throughout Tropical India. The glands and leaves.

Vernacular.—Kapála, Kamála (*Hind.*), Kamila (*Beng.*), Kapila, Kapita, Kamila (*Mar.*), Vasáré, Chandrahittu (*Can.*), Kámpilla (*Guz.*), Kapli, Kapila (*Tam.*), Kápila-pod (*Tel.*).

History, Uses, &c.—The glandular powder obtained from this plant has been used as a dye in India from a very remote period. It was probably collected, as at the present time, by the aboriginal tribes, who call it *Ruhin*, before the Hindus invaded India. In Sanskrit it is known as Kampilla, and bears the synonyms of Rochanika, Rochana-rakta and Lohita-rakta, in allusion to its red colour. In the Nighantas it is described as useful in removing phlegm, bile, stone, worms, enlarged glands, boils, &c., and the leaves are said to be astringent and cooling. In the *Bhavaprakása* one tola with treacle is said to kill and expel all intestinal worms. It is also prescribed for worms in combination with the seeds of *Embelia Ribes* (vaverang), chebulic myrobalans, carbonate of potash, and rock salt. (*Chakradatta.*) The Arabs became acquainted with Kampilla at an early date, and through them it appears to have reached Europe, and to have been known to the later Greek physicians about the 7th century. Ibn Massowiyeh, physician to the Caliph Haroon-el-Raschid, speaks of it as highly astringent, a good anthelmintic, and a useful application to moist eruptions of the skin, which it soon dries up. It is also mentioned by Rázi, Tamimi, Baghdádi, Ibn Sina, Ibn Baitar and others, all of whom appear to have been in much doubt as to its nature, but distinguish it from *Wars*, a product of Arabia, the source of which they were acquainted with. Ibn Sina says of Kanbíl:—"It is in grains like sand, red, but less so than *Wars*, hot and dry in the third degree; Ibn Massowiyeh considers to be highly astringent; it kills worms and flukes of the intestines and expels them." Of *Wars*, he says:—"It is a substance like powdered saffron, of an intense red colour (احمر قانی), brought for sale from Yemen; they say that it is scraped from a plant; it is hot and dry in the third degree, astringent; a useful application to pimples, freckles, &c." (A number of skin eruptions are named, the exact nature of which is doubtful.)

The author of the *Makhzan*, who wrote in India (1770), is strangely ignorant of the source of this drug. He says:—"Kinbíl is an Arabic form of the Persian Kampilla and Hindi Kamila"; he then recapitulates the various opinions held as to the source of the drug, and concludes by saying: "I have heard that it is the pulp of the fruit of a mountain-tree like the *Ma'asfar*, but its leaves are rather larger, and it is armed with long stiff thorns, and has fruit like a lime, which is green when young and red when ripe; when ripe it bursts open and a dull-red substance escapes and falls on the ground: this is collected, and is Kinbíl." Regarding its properties, he says that in doses of from 1 to 2 dirhems rubbed into an emulsion with any suitable vehicle it expels all kinds of intestinal worms, and at the same time acts as a purgative. Speaking of *Wars*, the same author says that there is a black kind, which comes from Ethiopia, and is called '*Habshi*,' and a dull-red kind which is called Indian, and is the worst (as a dye); he concludes by saying the seeds of the *Wars* are like Másh (*Phaseolus radiatus*). There is no mention of its use as an anthelmintic; it is described as an aphrodisiac, lithontriptic, and remedy for ringworm, pityriasis and freckles. Sprengel thought that the source of *Wars* was *Memecylon tinctorium.* (Confer. *Hist. Med.*, *t.* II., p. 444, ed. tert.; also *Hist. rei Herb.*, *t.* I., p. 258.)

Rheede first figured and described the plant; he states that the leaves, fruit and root with honey are applied to poisoned bites, bruises, &c. Buchanan (*Journey through Mysore in* 1801) notices Kamála; it has also been noticed by Ainslie, Roxburgh, and Royle, but Mackinnon of Bengal, in 1858, was the first to introduce it into European practice in India; since then it has been used with success by many medical men in India and Europe. Previous to this, Vaughan had sent Kamála to Hanbury from Aden under the name of *Wars*, and had described its use as a dye, and as a remedy in certain skin diseases. (*Pharm. Journ.*, Vol. xii., p. 386, 1853.) The true Arabian *Wars* does not appear to have attracted attention in Europe until 1867, when it was imported by Messrs. Allen and Hanburys of London. The source of *Wars* remained unknown until 1884, when it was ascertained to be the glands of the pod of *Flemingia Grahamiana*, a leguminous plant common in Arabia and India. (*See Flemingia.*)

As noticed in the *Pharmacographia*, the names Kanbíl and Kamála are not in use in the bazars at Aden; the Indian Kamála being now commonly known there as *Wars*.

The dose of Kamála is from one to two drachms, or one to three fluid drachms of a saturated tincture may be employed; it does not cause much nausea, colic, or purging. The parasite is generally discharged dead, and it appears to be equally efficacious in removing all kinds of worms. The dose should be repeated several times at intervals of about three hours.

Description.—Kamála is a red powder, which varies in depth of colour, mixed with it are greenish-yellow fragments of the capsule of the plant; like lycopodium it is inflammable and resists admixture with water. Alcohol and ether dissolve a considerable portion of it, and the solution poured in water emits a melon-like odour.

Microscopic structure.—Each grain of Kamála is a spherical body, consisting of an outer delicate membrane within which may be seen a structureless mass of yellow colour, in which are embedded numerous club-shaped cells, arranged with their thick ends outwards; in order to examine these cells the drug must be exhausted of its resin by alcohol or potash. The hairs which are found mixed with the glands are stellate, each hair being one-celled and thick-walled.

Chemical composition.—Pure Kamála contains only between ·5 and 3·5 per cent. of moisture, and yields to ether, alcohol, amyl alcohol, glacial acetic acid, or carbon disulphide, about 80 per cent. of resin, which is also soluble in alkalies, but not in benzine, and whose alcoholic solution is coloured dingy-green by ferric chloride. (*Flückiger.*) Leube (1860) analyzed a sample of Kamála which yielded nearly 29 per cent. of ash, 47·6 of resin, and 19·7 of other soluble matters, consisting of citric, oxalic, and tannic acids, gums, &c. Cold alcohol dissolved a resin, $C^{15}H^{18}O^{4}$, fusible at 80° C., and left a more sparingly soluble resin, $C^{8}H^{14}O^{5}$, melting at 191° C. Both resins are brittle, reddish-yellow, soluble in alkalies with a red colour, not altered by dilute acids, and when treated with nitric acid yield oxalic acid. Leube could not obtain Anderson's *Rottlerin*, $C^{11}H^{10}O^{3}$ or $C^{22}H^{20}O^{6}$ (1855), which crystallized from the concentrated ethereal tincture in yellow silky needles. Groves (1872) ascertained that it is easily modified by exposure to air, and is consequently obtained only from the recent drug. Flückiger subsequently observed that on being fused with potassa, rottlerin yields *paraoxybenzoic acid.* Anderson's *resinous colouring matter* has the compositiom $C^{30}H^{30}O^{7}$, melts at 100° C., is easily soluble in alcohol and ether, and yields with lead acetate an orange-coloured precipitate. By treating Kamála with boiling alcohol, and cooling, amorphous floccules of the composition $C^{20}H^{34}O^{4}$ are obtained, which are sparingly soluble in cold alcohol and ether, and are not precipitated by lead or silver salts. (*National Dispensatory.*)

Messrs. A. G. Perkin and W. H. Perkin, Junr. (*Berichte*, 1886), have recently separated from Kamála a substance which they name *Mallotoxin*, $C^{11}H^{10}O^{3}$ or $C^{18}H^{16}O^{5}$. It was obtained by shaking powdered Kamála with bisulphide of carbon, evaporating the solution, and treating the residue with just enough bisulphide of carbon to remove the resinous impurities. It was finally purified by crystallization from benzine or toluene. It formed small flesh-coloured needles, soluble in alkalies, alcohol and acetic acid, but insoluble in water. It appears to be identical with the rottlerin of Anderson. Later still, L. Jarvein (*Ber.*, xx., 182) obtained a yellow crystalline substance from Kamála, melting at 200°, to which he gave the same name and formula as Anderson's rottlerin.

The bark of this tree is astringent, and Professor Hummel found it to contain 6·5 per cent. of tannin.

Carefully selected, Kamála, according to P. Siedler, will not contain more than 1·5 per cent. of ash, whilst the commercial article yields from 21·8 to 49·1 per cent. By sifting, fractions may be obtained containing as low as 5·2 and as high as 25 per cent. High percentage of mineral matter may be due to careless collection, or to adulteration; in the latter case, the ash may range from 50 to 80 per cent. The percentage of ash has notably increased of late, and by sifting it is often impossible to get the drug containing less than 14 per cent. of ash. Of 45 samples examined by the author, only three contained less than 6 per cent. (*Pharm. Zeitg.*, 1891, 162.)

Commerce.—Kamála is collected in the N.-W. Provinces, the Concan and Madras, and is distinguished by the collectors as of two qualities, *Kapila* and *Kapili*; the latter is the best, and is obtained by shaking the fruit only in a basket to separate the glands. Kapila consists of the glands and other parts of the plant, and has a greenish tinge. The collection of the drug is an industry of the hill Khonds in Ganjam, who sell a few measures for a few measures of rice or a yard of cloth.

The average value of the best red Kamála is Rs. 11 per maund of 41 lbs. The high winds laden with dust, which often prevail in India, cause a certain amount of impurity in the drug from the adherence of dust to the capsules and leaves of the plant. Native dealers test the drug by taking it up on the moistened finger and rubbing it firmly upon a piece of white paper; if of good quality, a smooth paste is formed and the paper is stained of a bright-yellow colour.

RICINUS COMMUNIS, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 237; *Sibth. Fl. Græc. x.*, *t.* 952; *Hayne, Arneigew. x.*, *t.* 48; *Rheede, Hort. Mal. ii.*, *t.* 32. Castor plant (*Eng.*), Ricin commun (*Fr.*).

Hab.—Africa? Cultivated throughout India. The leaves, seeds, root, and oil.

Vernacular.—Arandi (*Hind.*), Erandi (*Mar.*), Bherenda (*Beng.*), Amanakkam-chedi (*Tam.*), Amudapu-chettu (*Tel.*), Avanakku (*Mal.*), Karala-gida (*Can.*), Erando (*Guz.*).

History, Uses, &c.—The Castor plant is called in Sanskrit Eranda, Ruvu, Ruvuka and Uruvuka, and the red variety Raktairanda; the root and the oil obtained from the seeds have been used medicinally by the Hindus from a very remote period, and are mentioned by Susruta.

Both root and oil are described as purgative and useful in costiveness, flatulence, rheumatism, fever and inflammatory affections; on account of its efficacy in rheumatism the plan bears the synonym of Vátári (váta-ári). As a purgative the oil is directed to be taken with cow's urine or an infusion of ginger or the decoction of the ten roots known as *dasamula* (see Vol. I., p. 243). The seeds freed from the husks and germs, and boiled in milk and water, form a decoction which is given in rheumatism; a decoction of the root with carbonate of potash is also prescribed, and most compound medicines given in rheumatic and neuralgic affections contain the root. The leaves are applied to the breast to stop the secretion of milk, and, boiled with the root in goat's milk and water, they are used as a local application in ophthalmia. When applied to the abdomen they are popularly thought to promote the menstrual flow; in *Govardhana* (203), the *halikavadhu*, or "peasant woman," is represented as lying in pain upon the leaves of the *Eranda.*

In the proverbial language of the Indians the Castor plant is emblematic of frailty; they say:—Naukri arand ki jar hai (service is like the root of the Castor plant). The Arabs appear to have first become acquainted with the tree in India, as they call the seeds Simsim-el-hindi, "Indian Sesamum," and the plant Khirvaa (خروع), a word which signifies any weak or frail plant; the properties they attribute to it are also those mentioned by Sanskrit writers. Again, in the *Saptasataka* of Hála, we find the large and swelling breasts of the peasant girl likened to the Eranda leaf, and in Arabic we have the expression امراة خروعة applied to a beautiful and tender girl.

R. communis is the Bidanjir and Kinnatu of the Persians; it also bears various local names, such as Gerchak in the Shahpur District, and Buzanjir, "goat's fig," in Khorasan.

Aitchison notices its cultivation round the borders of fields in the latter province, and in the Harirud District, for the sake of the oil which is used as a lamp oil, and says that the peasantry are unacquainted with its purgative properties. The plant was cultivated in Southern Europe at a very early date; it is the κίκι of Herodotus, the κρότων of Theophrastus (H.P.i.,16; C.P. ii.), and the κίκι or κρότων of Dioscorides (iv., 158), who observes that the name κρὸτων is given to the seed on account of its resemblance to an insect known by that name (*Ixodes Ricinus*, Latr.). He also notices Castor oil and its medicinal use. It is the Ricinus or Cicus of Pliny (15, 7), "a tree which grows in Egypt in great abundance; by some it is known as croton, by others as sili, and by others, again, as wild sesamum: it is not so very long since this tree was first introduced here. Eaten with food the oil is repulsive, but it is very useful for burning in lamps."

The Jews and Abyssinian Christians say that it was under this tree that Jonah sat, but in the English version the Hebrew word "*Kikajon*" is translated "gourd." For a history of the plant in Europe, the *Pharmacographia* may be consulted.

Mahometan medical writers describe two kinds, red and white: the red is said to be the most active. They consider the oil a powerful resolvent and purgative of cold humors, and prescribe it in palsy, asthma, colds, colic, flatulence, rheumatism, dropsy and amenorrhœa; of the seeds, 10 kernels rubbed down with honey are sufficient as a purge. A poultice of the crushed seeds is used to reduce gouty and rheumatic swellings, and inflammation of the breasts of women during lactation. The leaves have similar properties, but in a less degree. The fresh juice is used as an emetic in poisoning by opium and other narcotics; made into a poultice with barley meal it is applied to inflammatory affections of the eye. The root-bark is used as a purgative and alterative in chronic enlargements and skin diseases; it is also applied externally.

In modern medicine Castor oil is much valued as a non-irritant purgative; a drop is sometimes dropped into the eye to allay irritation, and, strange to say, the leaves are applied locally in Europe to promote the secretion of milk, whereas in India the native practice of applying them to stop the secretion of milk is recognised in the Government hospitals under European superintendence. A fluid extract of the leaves has also been recommended in Europe as a lactagogue. As a purgative the oil is best administered in the early morning on an empty stomach, when about one drachm will usually be found sufficient, at other times at least half an ounce will be required. Various fluids have been recommended to conceal the taste of the oil, such as brandy, peppermint water, &c., but the decoction of fresh ginger, as used in India, is, we think, the best vehicle. The above remarks apply to cold drawn oil; the bazar oil extracted by boiling is more active, and, as it is not always carefully prepared, it may contain the acrid principle of the seed and give rise to disagreeable symptoms. The alleged antirheumatic properties of the plant so insisted upon by Hindu and Mahometan physicians are worthy of being tested by careful clinical observation.

M. H. Meyer (*Pharm. Zeitsch. f. Russland,* xxx., p. 282, 1891), in order to decide the question as to the purgative properties of ricinoleic acid, prepared that substance perfectly pure, also its glyceride, and ricinelaïdic acid. All these preparations were administered to cats, and acted as purgatives. The author concludes that there is no reason to suppose that Castor oil contains any purgative principle other than ricinoleic acid.

Dr. H. Stillmark has discovered in the seeds an albuminoid body which he has named "*Ricin.*" This, however, does not appear to be the purgative principle. Its action, whether given by the mouth or hypodermically, is to produce hæmorrhagic inflammation of the gastro-intestinal tract, affecting primarily the small intestines, and probably obstructing the bile duct, since there is usually extreme fullness of the gall bladder; the inflammation also extends to the vesical mucous membrane. Diarrhœa is by no means constant. The drowsiness and convulsions which occurred in some of his experiments on animals he attributes to possible thrombosis of the cerebral vessels. The lethal dose of ricin for man he calculates to be 6·0 milligrams for a man weighing 60 kilograms, this generally being equal to about ten ordinary seeds, although Christison once had a fatal case, where only three seeds had been swallowed, and, on the other hand, a case is on record in which a person who had eaten 17 seeds, recovered.

Ricin appears to have a peculiar effect upon blood, causing a rapid conglomeration of the red corpuscules, together with the formation of a substance like fibrin. One part of ricin to 60,000 of defibrinated blood is sufficient to cause a separation of the serum, so that the latter is capable of being passed through a filter. Crotonoleic acid, which exists in croton seeds, was found to be quite distinct from ricin.

The results obtained by Dr. Stillmark find further confirmation in a note in the *Medical Recorder* (July, p. 299), in which it is stated that fifteen children, under six years of age, poisoned by eating castor seeds, suffered from severe vomiting and prostration, but not from catharsis.

Ehrlich (*Deutsche Med. Wochenschr.*, No. 32, p. 976, 1891) reports some interesting experiments with ricin. He found that injected into the veins of animals, it is fatal in doses of three milligrams per kilo of body-weight; taken internally it is a hundred times less active, but still so poisonous that 0·18 gram is a fatal dose for an adult man. He found different animals to be unequally affected by it; guinea pigs were especially susceptible to the poison, but white mice much less so. The symptoms were diarrhœa and prostration: on *post-mortem* examination the appearances in some cases were such as are seen in cholera, but more frequently there was a hæmorrhagic condition of the intestines and often of the subcutaneous cellular tissue.

Ehrlich also succeeded in rendering animals insusceptible to the poison by administering gradually increasing doses internally: at the end of two months of this treatment he found that mice could bear a dose of 5 decigrams of ricin (sufficient to kill an adult man), the fatal dose for an unprotected mouse being 35 milligrams.

The immunity obtained was still more marked in experiments on the conjunctiva; under ordinary circumstances touching the membrane with a 1 per cent. solution of ricin produced intense inflammation, but after several weeks of protective treatment the strongest solution could be freely applied without producing any effect.

The establishment of the immunity appears to commence suddenly on the sixth day, and continues to increase from that time. The author insists upon the similarity between this

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sudden immunity and the critical subsidence of fever in certain acute diseases, such as pneumonia, measles, &c., which he considers may also be regarded as indicating the establishment of an immunity in those diseases.

Animals in which an immunity to the ricin poison had been established, were found, six months after the cessation of all treatment, to be incapable of being affected by the poison. Ehrlich has also made similar experiments with *abrin*, the active principle of *Abrus precatorius*, which he reserves for early publication.

Description.—There are many varieties of the plant which have been produced by cultivation; they may be divided into the large red-seeded kinds, and those with grey seeds marked with brown blotches; the latter are preferred for medicinal use.

The roots are tolerably straight, and give off a few rootlets; they are covered by a light-brown bark, nearly smooth, but marked with little transverse warty ridges. The wood is white and soft. The bark has an acrid taste.

The seeds are contained in a tricoccous capsule, one in each cell; they are oblong, from ¼ to ½ an inch long and about ⅓ of an inch broad, the dorsal surface is more arched than the ventral. The apex is somewhat pointed, below it is a tumid caruncula, on the removal of which a dark depressed cicatrix is seen. The testa is grey, marked with brown blotches. The kernel is enclosed in a delicate white membrane, and consists of a copious white albumen, in the axis of which are situated two leafy cotyledons and a short stout radicle.

Microscopic structure.—The epidermis of the seeds is composed of tabular cells, which are here and there coloured in patches which correspond to the spots on the seed. The testa consists of cylindrical cells in close apposition. The kernel is a mass of closely-packed cells with granular contents, but if water is brought in contact with the section, oil globules separate from the albumen. In the latter may be demonstrated the

Aleurone crystals which are found in many seeds. (*Sachs Lehrbuch der Botanik*, p. 554.) The root-bark shows numerous cells filled with a yellow refractive substance which appears to be resinous; in other respects it is not remarkable.

Chemical composition.—The most important constituent of the seeds is the fixed oil called castor oil, of which the peeled kernels afford at most half of their weight.

The authors of the *Pharmacographia* say :—

"The castor oil of commerce has a sp. gr. of about 0·96, usually a pale yellow tint, a viscid consistence, and a very slight yet rather mawkish odour and taste. Exposed to cold, it does not in general entirely solidify until the temperature reaches —18°C. In thin layers it dries up to a varnish-like film.

"Castor oil is distinguished by its power of mixing in all proportions with glacial acetic acid or absolute alcohol. It is even soluble in four parts of spirit of wine (·838) at 15° C., and mixes without turbidity with an equal weight of the same solvent at 25° C. The commercial varieties of the oil, however, differ considerably in these as well as in some other respects.

"The optical properties of the oil demand further investigation, as we have found that some samples deviate the ray of polarized light to the right and others to the left.

"By saponification, castor oil yields several fatty acids, one of which appears to be *Palmitic Acid*. Another acid (peculiar to the oil) is *Ricinoleic Acid*, $C^{18}H^{24}O^{3}$; it is solid below 0° C.; does not solidify in contact with the air by absorption of oxygen, and is not homologous with oleic or linoleic acid, neither of which is found in castor oil. Castor oil is nevertheless thickened, if 6 parts of it are warmed with 1 part of starch and 5 of nitric acid (sp. gr. 1·25), *Ricinelaïdin* being thus formed. From this, *Ricinelaïdic Acid* may easily be obtained in brilliant crystals.

"As to the albuminoid matter of the seeds, Fleury (1865) obtained 3·23 per cent. of nitrogen, which would answer to about 20 per cent. of such substances. The same chemist further extracted 46·6 per cent. of fixed oil, 2·2 of sugar and mucilage, besides 18 per cent. of cellulose.

"Tuson, in 1864, by exhausting castor oil seeds with boiling water, obtained from them an alkaloid which he named *Ricinine.* He states that it crystallizes in rectangular prisms and tables, which ,when heated, fuse, and, upon cooling, solidify as a crystalline mass; the crystals may even be sublimed. Ricinine dissolves readily in water or alcohol, less freely in ether or benzol. With mercuric chloride, it combines to form tufts of silky crystals, soluble in water or alcohol. Werner (1869), on repeating Tuson's process on 30 lbs. of Italian castor oil seeds, also obtained a crop of crystals, which in appearance and solubility had many of the characters ascribed to ricinine, but differed in the essential point that when incinerated they left a residuum of magnesia. Werner regarded them as the magnesium salt of a new acid. Tuson repudiates the suspicion that ricinine may be identical with Werner's magnesium compound. E. S. Wayne of Cincinnati (1874) found in the leaves of Ricinus a substance apparently identical with Tuson's ricinine; but he considers that it has no claim to be called an alkaloid.

"The testa of castor oil seeds afforded us 10·7 per cent. of ash, one-tenth of which we found to consist of silica. The ash of the kernel previously dried at 100°C., amounts to only 3·5 per cent." (*Op. cit.*, 2nd Ed., p. 569.)

K. Hazura and A. Grüssner (*Moniteur Scient.*, Ap. 1889) infer from their experiments that the liquid acid of castor oil is not a single compound, as has been hitherto supposed, but a mixture of two isomeric acids of the composition $C^{18}H^{34}O^{3}$, one of which, ricinoleic acid, yields on oxidation trioxystearic acid, whilst the other, ricinisoleic acid, yields isotrioxystearic acid. The proportion of these acids is about 1 of the former to 2 of the latter. As no dioxystearic acid has been obtained from the oxidation of the liquid acids of castor oil, it may be concluded that of all the fatty oils hitherto examined, castor oil is the only one which contains no oleine.

The leaves, stem, and root of *R. communis* contain the same active principles as the seeds; a proximate analysis by A. L. Beck (*Amer. Journ. Pharm.*, 1888) gave the following results:—

	Leaves.	Stem.	Root.
Extracted by petroleum spirit	4·582	0·275	0·380
„ „ ether	2·575	0·316	0·338
„ „ alcohol	2·490	0·833	......
„ „ water	12·699	......	......
„ „ diluted $NaOH$	1·200	......	......
„ „ „ HCl	2·193	......	......
Loss by chlorine	5·440	......	......
Residues, cellulose, &c.	43·590	......	......
Ash	11·220	5·466	7·050
Moisture	12·700	6·100	7·083
Loss	1·311	......	......

The poisonous principle present in castor oil seeds has been variously represented as an alkaloid, a glucoside, and an organic acid. But as the result of an exhaustive chemical and pharmacological investigation, recorded in a lengthy treatise (*Arbeit. d. Pharmakol. Inst. Dorpat*, Part III., p. 59), Herr Stillmark has come to the conclusion that it is an albuminoid body, identical with the "B. phytalbumose," separated from the dried juice of *Carica Papaya* by Sidney Martin, and belonging to the class of unformed ferments. This substance, which he has named "ricin," may be prepared by exhausting well-pressed peeled Ricinus seeds, reduced to powder, with a 10 per cent. solution of sodium chloride, saturating the clear percolate at the ordinary temperature with magnesium sulphate and sodium sulphate, and keeping it in a cool place, when, besides large crystals of the two sulphates, a white precipitate, easily separable from these, is formed. This is placed in a dialyser, with frequent changes of water, for six days, after which the residue is removed and dried over sulphuric acid, and can then be reduced to a snow-white powder, which still contains 10 to 20 per cent. of sulphate. This substance is a most powerful poison, exercising a remarkable power of coagulation, so that the blood coming into contact with a minute quantity that has been absorbed is coagulated, blocks the lumina of the intestinal capillaries, and causes thrombosis and ecchymosis. Even when introduced subcutaneously, the principal action of the poison appears to occur in the intestinal canal, and not at the place of injection. The lethal dose for a man weighing sixty kilograms is estimated as 0·18 gram, and it is stated that this quantity is contained in the press-cake from 3 grams of peeled seeds. In view of this fact, that the residue from the pressing of castor oil contains such large quantities of a tasteless poison exceeding arsenic in toxic power, and at present not to be detected in the body by any known method, Herr Stillmark raises the question, whether it should not be made compulsory upon manufacturers to burn the cake, or render it harmless by a process of boiling that would destroy the ferment. Experiments were also made upon the seeds of nine other species of Ricinus, as well as those of *Croton Tiglium* and *Jatropha Curcas*, and in each case a poisonous albuminoid substance was separated, similar to, if not identical with, ricin, and belonging to the class of ferments. It is pointed out by the author that the coagulating power of ricin explains the external application in some countries of crushed Ricinus seeds as a hæmostatic. (*Pharm. Journ.*, Nov. 2nd, 1889.)

Commerce.—Several varieties of the castor plant are cultivated in India: they may be divided into large-seeded and small-seeded. The seeds of the latter variety only are exported, those of the former being used in India for the preparation of an inferior kind of oil which is used for lubricating machinery, &c.

The exports of seed from 1885-86 to 1888-89 were:—

1885-86	34,000	tons,	valued at	30 lakhs	of Rupees.
1886-87	31,000	„	„	29 „	„
1887-88	36,000	„	„	34 „	„
1888-89	29,000	„	„	31 „	„

Most of the castor seed goes to Italy.

The exports of oil, mostly from Bengal, during the same period, were:—

1885-86...2·2 millions of gallons, valued at 22 lakhs of Rupees.
1886-87...2·7 „ „ „ 27 „ „
1887-88...2·7 „ „ „ 26 „ „
1888-89...2·7 „ „ „ 26 „ „

Almost the whole of the oil goes to England.

Ricin has been introduced into commerce by Merck of Darmstadt.

BALIOSPERMUM AXILLARE, *Blume.*

Fig.—*Wight Ic., t.* 1885; *Rheede, Hort. Mal. x., t.* 76.

Hab.—Tropical and Subtropical Himalaya. Deccan Peninsula. The root and seeds.

Vernacular.—Danti (*Hind., Beng., Mar., Gus.*), Kondá-ámádam (*Tel.*), Nága-danti (*Tam., Mal.*).

History, Uses, &c.—This plant, in Sanskrit Danti, Nágádanti or Danta-mulika, with numerous synonyms, such as Upachitra, Makulaka, &c., is much used in Hindu medicine where purgation is indicated, the root being generally prescribed. The seeds (Danti-vija) are also used, and are sometimes sold in the shops as croton seeds. The following formula from Chakradatta will show how the root is prescribed:—

"*Dánti haritaki.*—Take 25 large chebulic myrobalans and enclose them in a piece of cloth, then take of the roots of *Baliospermum axillare* and *Ipomœa Turpethum*, each 200 tolas, water 64 seers, boil them together till the water is reduced to 8 seers. Strain the decoction, take out the chebulic myrobalans and fry them in 32 tolas of sesamum oil. To the strained decoction add 200 tolas of old treacle, then boil till reduced to the proper consistence for a confection. Now add to the mass the following substances: powdered root of *Ipomœa Turpethum* 32 tolas, long pepper and ginger, each 8 tolás, and stir them well; when cool, add 32 tolas of honey; cinnamon, cardamoms, tejpat leaves, and the flowers of *Mesua ferrea*, each 8 tolas, and prepare a confection. The chebulic myrobalans should be kept embedded in the medicine. Two tolas of the confection and one of the myrobalans are to be taken every morning."

A more simple formula from the Bhavaprakasa is the *Gudáshtaka*. Take of *danti*, *trivrit* (*Ipomœa Turpethum*), and plumbago root, black pepper, ginger and long pepper root, equal parts in fine powder; treacle, equal in weight to all the other ingredients, and mix. Dose about a tola every morning, in flatulence, anasarca, jaundice, &c.

Rheede says of Danti:—Folia, radix atque fructus, tanta purgandi pollent energia, ut solus odor catharsin excitet: folia extrinsice applicata articulari medentur morbo."

Roxburgh remarks:—"The seeds are esteemed by the natives a good purgative; they administer one seed bruised up with water for every evacuation they wish the patient to have. There would appear to be little doubt that the seeds of this plant were the original Dand of the Arabian physicians, but were subsequently superseded by those of *Croton Tiglium*, as has been the case in India.

Description.—Roots nearly straight, seldom branched, about as thick as the finger; bark brown, scabrous; wood yellowish-white, soft and tough. The outer layer of the bark consists of several rows of brick-shaped brown cells, mostly empty, but some of them containing a dark reddish-brown resin; within this the parenchyma is so loaded with conglomerate raphides that its structure is with difficulty seen; it has many cells filled with resin as in the suber, and very numerous yellow liber cells. The wood is loaded with starch.

The seeds weigh about one and a half grains each, and are exactly similar to very small castor seeds.

Commerce.—The seeds are no longer found in the bazars, having been superseded by the imported croton seeds; the root is also difficult to obtain, that sold in the shops as Danti-mul being usually the root of *Ricinus communis*.

TRAGIA INVOLUCRATA, *Linn.*

Fig.—*Burm. Zeyl.*, *t.* 92; *Rheede, Hort. Mal.* *ii.*, *t.* 39; var. *cannabina*, *A. Juss. Tent. Euphorb.*, *t.* 15, 49 B.

Hab.—Throughout India. The root.

Vernacular.—Barhanta (*Hind.*), Bichati (*Beng.*), Kanchuri, (*Tam.*), Kánchkuri, Khájkolti (*Mar.*), Dulaghondi (*Tel.*), Haligilu (*Can.*).

History, Uses, &c.—This very variable plant, of which four varieties are described in the *Flora of British India*, is the Vrischikáli of the Rája Nirghanta, where it is said to bear the same name in Marathi and to be called Haligilu in Canarese. It is recommended in bilious fever, and as a diuretic and alterative. Rheede says of it:—"Conducit in febre ossium, ac servit pro pruritu corporis; in decocto data urinam suppressam movet." He also notices its use on the doctrine of signatures as a remedy for the sting of the Ray fish.

Ainslie (ii., 61 and 389) says:—"The root, which is sometimes called 'Coorundootievayr,' has in its dried state but little taste or smell, though in its more succulent condition it has a rather pleasant odour; it is considered as diaphoretic and alterative, and is prescribed in decoction, together with other articles of like virtues, to correct the habit in cases of *mayghúm* (cachexia), and in old venereal complaints, attended with anomalous symptoms; an infusion of it is also given as a drink in ardent fever, in the quantity of half a teacupful twice daily."

In the Concan the roots of these plants are used to aid the extraction of Guinea-worm, a paste made from them being applied to the part. A paste of the roots with Tulsi juice is also used as a cure for itchy eruption of the skin. In Tanjore, the root is boiled with cow's milk and taken at bedtime for dry cough.

Description.—Shrubby, climbing, 4 to 5 feet high; leaves petioled, 3-divided, serrate, hairy, 2 to 4 inches long; stipules half lanceolate; racemes erect, many-flowered; male flowers numerous on the upper part of the raceme, very small, yellow, each with three bracts; female flowers beneath the male, two on each raceme, with the calyx leaflets pinnatifid. The plant stings like the nettle. For a description of its varieties, the reader is referred to the *Flora of British India.*

EXCÆCARIA AGALLOCHA, *Linn.*

Fig.—*Wight Ic., t.* 1865 *B; Rheede, Hort. Mal. v., t.* 45. Blinding tree, Tiger's milk tree (*Eng.*), Arbre aveuglant (*Fr.*).

Hab.—Tidal forests of India. The juice and cork.

Vernacular.—Gaoura, Uguru, Gangwa, Geria (*Beng.*), Chilla (*Tel.*), Haro (*Can.*), Gevá, Phungali, Hura (*Mar.*), Tillai-cheddi (*Tam.*).

History, Uses, &c.—This tree was named *Agallocha* by the old botanists, from a supposition that a kind of Aloe-wood was yielded by it; but Loureiro, speaking of *E. cochin-chinensis*, remarks, "nec agallochum, quamvis spurium, in illa inveneri." The wood is white, soft, and spongy, and has no aromatic properties. All parts of the tree abound in an acrid milky juice, which causes intense pain if it gets into the eyes; this juice is said to be used in Australia and New Guinea to cure ulcers, leprosy, &c. If collected it hardens into a kind of caoutchouc, a grain or two of which is used by the boatmen on the Western Coast of India as a purgative. Ainslie (ii., 438) states that a decoction of the leaves is occasionally given by Hindu doctors in epilepsy, in the quantity of a quarter of a teacupful twice daily. This decoction is also used as an application to ulcers.

Smith (*Econ. Dict.*, 5) states that in Fiji the plant is employed for the cure of leprosy, its mode of application being very singular. The body of the patient is first rubbed with the green leaves; he is then placed in a small room and bound hand and foot, and a small fire is made of pieces of the wood, from which rises a thick smoke; the patient is suspended over this fire, and remains for some hours in the midst of the poisonous smoke, enduring the most agonising torture and often fainting. When thoroughly smoked, he is removed, and the slime is scraped from the body; he is then scarified and left to await the result, which, if the patient survives, is said to be a cure.

From the lower part of the trunk and roots of this tree a soft, light, reddish suber is obtained, which is sold by the itinerant medicine men of Western India, under the name of *Tejbul,* as an aphrodisiacal tonic. It occurs in irregular-shaped pieces about half an inch thick, and often as large as the palm of the hand, from which the epidermis has been removed by scraping and trimming. The structure is that of coarse cork, the cells being about six times the size of ordinary cork cells. This substance has a glistening appearance, and is always kept saturated with water, so that on breaking it, it appears to be full of juice. It is inodorous and tasteless.

On some parts of the Coast it is said to be used for making floats for fishing nets.

Description.—A small evergreen tree or shrub, growing along with Rhizophora and Avicennia, and sometimes called the "milky mangrove." Leaves ovate, between fleshy and coriaceous, 2 to 4 inches, entire or sinuate crenate, pale brown when dry, base acute or rounded; nerves many, very faint, subhorizontal; petiole ½ to 1 inch. Flowers fragrant, male spikes numerous, 1 to 2 inches; female racemes few, ½ to 1 inch. Bracts of male spike with one flower and several minute bractioles. Filaments much lengthened after flowering. Styles free nearly to the base. Seeds subglobose, smooth. The variations in the size of the fruit and seeds are remarkable. (*Fl. Br. Ind.*)

Plants of minor importance belonging to this order, which are used medicinally, are:—

Macaranga Roxburghii, *Wight Ic., t.* 817, a small tree of the Deccan Peninsula, with peltate, cordate leaves, small green flowers, and fruit the size of a pea. The young shoots and fruit are covered with a clammy, reddish secretion having an odour like turpentine. The country people use the following in *Jarandi* (*Angl.,* Liver):—One part of the young shoots, with 3 parts of the young shoots of Khoréti (*Ficus asperrima*), are sprinkled with hot water and the juice extracted; in this is rubbed down 2 parts each of the barks of both trees. The preparation may be administered twice a day in doses of ⅛ of a seer. The Marathi name is Chándvar. The bark contains 18·4 per cent. of tannic acid, giving a blue-black precipitate with ferric chloride, and the air-dried bark leaves 11 per cent. of mineral matter on incineration.

Chrozophora plicata, *A. Juss., Burm. Ind., t.* 62, *f.* 1, is a common weed on cultivated ground, and in the bottoms of dried up tanks in many parts of tropical India in the cold season. It is reputed to have alterative properties, and is mentioned by Ainslie as a plant which Dr. F. Hamilton had brought to him in Behar, as one of those which was supposed to have virtues in leprous affections; the dry plant is made into a decoction to which is added a little mustard. (*Mat. Ind.,* ii., 398.)

Sebastiania Chamælea, *Müll-Arg., the Cadi-avànacu* of Rheede (ii., 34), and the Bhui-erandi of the Concan, is a small plant, with linear, finely serrated leaves and small spinous cocci, the juice of which in wine is used as an astringent; a *ghrita* of the plant is considered to be tonic, and is applied to the head in vertigo.

URTICACEÆ.

GIRONNIERA RETICULATA, *Thwaites.*

Fig.—*Bedd. Fl. Sylv., t.* 313. Syn., *Celtis reticulata.*

Hab.—Sikkim, Himalaya, Assam, Burma, Pegu, Deccan Peninsula, Ceylon. The wood.

Vernacular.—Koditáni (*Tam.*), Kho-manig (*Nilgiri*), Nárakiya-ood (*Ind. Bazars*).

History, Uses, &c.—This wood does not appear to be mentioned by Indian medical writers, nor can we find any record of its collection in India for medicinal use, the bazars being supplied from Ceylon, where it has probably been in use from a remote period.

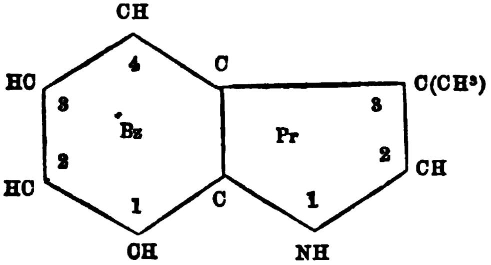
Thunberg says :— "The tree is called by the Dutch *Strunt-hout*, and by the Cingalese *Urenne*, on account of its disgusting odour, which resides especially in the thick stem and the larger branches. The smell of it so perfectly resembles that of human ordure, that one cannot perceive the smallest difference between them. When the tree is rasped, and the raspings are sprinkled with water, the stench is quite intolerable. It is nevertheless taken internally by the Cingalese as an efficacious remedy. When scraped fine and mixed with lemon juice, it is taken internally, as a purifier of the blood in itch and other cutaneous eruptions, the body being at the same time anointed with it externally." (*Thunberg's Travels*, iv., 234.)

Thunberg obtained leaves and young plants of the tree, but no blossoms; the plants were all killed by cold in the English Channel.

The Portuguese call the wood *Pao de merda* or *Pao sujo.* In India it is burnt as a fumigatory to drive away evil spirits; the bazar name signifies "hellish incense." In Ceylon, according to Mr. J. Alexander, it is hung up near dwelling-houses as a charm to keep away evil spirits. As sold in the bazars it is a light-brown wood in irregular-shaped pieces, having a penetrating odour, exactly similar to that of fresh human ordure.

Chemical composition.—The wood has been examined by Prof. W. R. Dunstan. By distillation with water a minute quantity of a solid crystalline substance was obtained. It possessed a fæcal odour, and after purification melted at 93·5°C. Its physical and chemical properties were not those of α-naphthylamine. It afforded a crystalline picrate, by the analysis of which the substance was shown to possess the composition of methyl-indole (C^9H^9N), and by its physical and chemical properties it was proved to be identical with the Pr. 3 methyl-indole, or skatole, which Brieger isolated in 1877 from human fæces, and Salkowski soon afterwards obtained from among the putrefaction products of animal proteid. Nenchi has observed the formation of the same substance when potash is fused with albumen, and it has also been prepared synthetically. Skatole from *G. reticulata* corresponds in all its properties with synthetical skatole from propylidene phenyl-hydrazide. The occurrence of skatole in a plant has not hitherto been observed; it has appeared to be a characteristic product of the bacterial resolution of animal proteid. (*Pharm. Journ.*, June 15th, 1889.)

The nomenclature followed is that which has been proposed by Emil Fischer. The benzene nucleus of indole being designated by *Bz*, and the pyrrole nucleus by the contraction *Pr*, the nitrogen of the pyrrole nucleus is numbered 1, as well as the corresponding carbon atom of the benzene nucleus; thus the formula of skatole is—



Holoptelea integrifolia, *Planch.*, *Wight Ic.*, *t.* 1968; *Roxb. Cor. Pl.*, *t.* 78; *Bedd. Fl. Sylv.*, *t.* 310, a tree extending from the Lower Himalayas to Travancore, has a mucilaginous bark, which is boiled and the juice squeezed out and applied to rheumatic swellings; the exhausted bark is then powdered and applied over the parts covered by the sticky juice. The vernacular names of the tree are Papri (*Hind.*), Aya (*Tam.*), Navili (*Tel.*), Vavala (*Mar.*), Rasbija (*Can.*)

CANNABIS SATIVA, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 231; *Reichb. Ic. Fl. Germ.*, *t.* 655; *Rheede, Hort. Mal. x.*, *tt.* 60, 61. Hemp (*Eng.*), Chanvre (*Fr.*).

Hab.—N.-W. Himalaya. Cultivated in India. The leaves, female flowering tops, resinous exudation, and seeds.

Vernacular.—The leaves—Bhang, Sabji (*Hind.*, *Beng.*, *Mar.*), Ganja-ilai, Bangi-ilai (*Tam.*), Ganja-aku, Bangi-aku (*Tel.*), Kancháva-ela (*Mal.*), Bangi (*Can.*), Bháng (*Guz.*). Flowering tops—Gánja (*Hind.*, *Beng.*, *Guz.*), Ganja (*Tam.*, *Tel.*, *Mar.*), Kancha (*Mal.*), Bangi (*Can.*). The resin—Charas (*Hind.*, *Beng.*, *Guz.*, *Mar.*), Ganja-pál (*Tam.*), Ganja-rasam (*Tel.*), Kanchava-pála (*Mal.*), Bangi-gondu (*Can.*). The seeds—Gánje-ke-bij (*Hind.*), Ganja-virai (*Tam.*), Ganja-vittulu(*Tel.*), Kanchava-vitta (*Mal.*), Bangi-bija (*Can.*), Ganja-bij (*Beng.*), Bhanga-cha-bi (*Mar.*), Bháng-nu-bi (*Guz.*).

History, Uses, &c.—The hemp plant, in Sanskrit Bhanga and Indrasana, "Indra's hemp," has been known in the East as a fibre plant from prehistoric times. It is mentioned along with the Vedic plant Janjida, which has magic and medicinal properties, and which is described in the Athavaveda (ix., 34, 35) as a protector, and is supplicated to protect all animals and properties. The gods are said to have three times created this herb (oshadhi). Indra has given it a thousand eyes, and conferred on it the property of driving away all diseases and kiilng all monsters; it is praised as the best of remedies, and is worn as a precious talisman; along with hemp it prevents wandering (vishkandha), fever and the evil eye. De Gubernatis says that in Sicily the peasant women still believe in hemp as an infallible means of attaching their sweethearts. On Good Friday they take a thread of hemp and twenty-five needlefuls of coloured silk, and at midnight weave them together, repeating the following lines:—

Chistu è cánnavu di Christu
Servi pi attaccari a chistu.

"This is the hemp of Christ; it serves to attach this man." They then enter the Church with the thread in their hands, and at the moment of the consecration of the host, they make three knots in it, adding at the same time some hairs of the man they are in love with, and invoke all the demons to attract him to his sweetheart. (*Cf.* Mattia 'di Martino, *Usi e credenze popolari Siciliane*, Woto, 1874.) Burns in "Halloween" notices a closely-allied superstition. The intoxicating properties which the plant possesses in its Eastern home appear not to have been discovered until a more recent date, but in the fifth chapter of Menu, Brahmins are prohibited from using it, and in the sacred books of the Parsis the use of *Bana* for the purpose of procuring abortion is forbidden. In Hindu mythology the hemp plant is said to have sprung from the *amrita* produced whilst the gods were churning the ocean with Mount Mandara. It is called in Sanskrit Vijaya, "giving success," and the favourite drink of Indra is said to be prepared from it. On festive occasions, in most parts of India, large quantities are consumed by almost all classes of Hindus. The Brahmins sell Sherbet* prepared with *Bhang* at the temples, and religious mendicants collect together and smoke *Ganja*. Shops for the sale of preparations of hemp are to be found in every town, and are much resorted to by the idle and vicious. Hemp is also used medicinally; in the *Rája Nirghanta* its synonyms are Urjaya and Jaya, names which mean promoter of success, Chápala "the cause of a reeling gait," Ananda "the laughter moving," Harshini "the exciter of sexual desire"; among other synonyms are Kashmiri "coming from Kashmir," Matúláni "the maternal uncle's wife," Mohini "fascinating," &c. Its effects on man are described as excitant, heating, astringent; it destroys phlegm, expels flatulence, induces costiveness, sharpens the memory, excites appetite, &c. Susruta recommends the use of Bhang to people suffering from catarrh. In the *Rájavalabha*, a recent work in use in Bengal, we are informed that the gods through compassion on the human race sent hemp, so that mankind by using it might attain delight, lose fear, and have sexual desires.

The seductive influences of hemp have led to the most extravagant praise of the drug in the popular languages of India, but in truth it is one of the curses of the country; if its use is persisted in, it leads to indigestion, wasting of the body, cough, melancholy, impotence and dropsy. After a time its votary becomes an outcaste from society, and his career terminates in crime, insanity, or idiotcy.

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* *Sabzi* or *Sabji*, an infusion of *Bhang* with black pepper, anise and sugar. In Bengal milk, and cucumber and melon seeds are added.

> *Ganja pie gur-gyan ghate, aur ghate tan andar ka,*
> *Khokat, khokat dam nikse, mukh dekho jaisa bandar ka.*
>
> Who ganja smoke do knowledge lack, the heart burns constantly,
> The breath with coughing goes, the face as monkey's pale you see.
> *Fallon.*

According to tradition, the use of hemp as an intoxicant was first made known in Persia by Birarslan, an Indian pilgrim, in the reign of Khusru the first (A.D. 531—579), but, as we have already stated, its injurious properties appear to have been known long before that date.

There can be no doubt that the use of hemp as an intoxicant was encouraged by the Ismailians in the 8th century, as its effects tended to assist their followers in realising the tenets of the sect:—

> بنکی زدیم سر اناالحق شد آشکار
> مارا باین کیاه ضعیف این کمان نبود
>
> We've quaffed the emerald cup, the mystery we know,
> Who'd dream so weak a plant such mighty power could show!

Hasan Sabáh, their celebrated chief, in the 11th century notoriously made use of it to urge them on to the commission of deeds of daring and violence so that they became known as the Hashsháshin or "Assassins." Hasan studied the tenets of his sect in retirement at Nishapur, doubtless at the monastery noticed by O'Shaughnessy (*Bengal Dispensatory*), in the following terms:— "Haidar lived in rigid privation on a mountain between Nishapur and Rama, where he established a monastery; after having lived ten years in this retreat, he one day returned from a stroll in the neighbourhood with an air of joy and gaiety; on being questioned, he stated that, struck by the appearance of a plant, he had gathered and eaten its leaves. He then led his companions to the spot, who all ate and were similarly excited. A tincture of the hemp leaf in wine or spirit seems to have been the favourite formula in which Sheikh Haidar indulged himself. An Arab poet sings of Haidar's emerald cup, an evident allusion to the rich green colour of the tincture. The Sheik survived the discovery ten years, and subsisted chiefly on this herb, and on his death his disciples at his desire planted it in an arbour round his tomb. From this saintly sepulchre the knowledge of the effects of hemp is stated to have spread into Khorasán. In Chaldea it was unknown until 728 A. H., the kings of Ormus and Bahrein then introduced it into Chaldea, Syria, Egypt and Turkey."

Taki-ed-din Ahmad, commonly known as Makrizi, who wrote a number of treatises upon Egypt in the 14th century, mentions the lease of the monopoly for the sale of Hashish in that country, and its abolition in (1286) by the Sultan.

Haji Zein in the Ikhtiárát (1368), after noticing the two kinds of Kinnab mentioned by the Greeks, states that Indian hemp is known as *Bang* or *Sabz* in Shiraz; after describing its properties, he says that in cases of poisoning by it vomiting should be induced by the administration of butter and hot water to empty the stomach, and that afterwards acid drinks should be administered.

The Greeks were acquainted with hemp more than 2000 years ago; Herodotus (iv., 74, 75) mentions it as being cultivated by the Scythians, who used its fibre for making their garments, and the seeds to medicate vapour baths. Dioscorides mentions two kinds of καννάβις, the wild and the cultivated; the former is the *Althæa cannabina* of Linneus, and the latter *Cannabis sativa;* he states that the seeds, if eaten too freely, destroy the virile powers, and that the juice is used to relieve earache. Galen and the early Arabian physicians, such as Ibn Sina and Rázi, follow Dioscorides in his opinion of the properties of hemp, and do not notice its having any intoxicating properties, and unless the *Gelotophyllis* of Pliny (24, 102) was Indian hemp, there is no evidence to show that the ancients were acquainted with them. Pliny says:—"The Gelotophyllis (laughing leaf) is a plant found in Bactriana, and on the banks of the Borysthenes. Taken internally with myrrh and wine, all sorts of visionary forms present themselves, and excite the most immoderate laughter, which can only be put an end to by taking kernels of the pine nut, with pepper and honey, in palm wine." The earliest Western medical writer who distinctly mentions the intoxicating properties of hemp is Ibn Baitar, a native of Africa, who died in Damascus in 1248. All the later Mahometan physicians describe the two kinds of Kinnab mentioned by the ancients, whom they quote, and a third kind called *Hindi* or Indian. The name Cannabis is derived from the Persian Kanab. which is connate to the Sanskrit S'ana, the Russian Kanopla, the Irish Canaib, the Iceland Hanp, the Saxon Hænep, and the old German Hanaf.

The author of the *Makhzan-el-Adwiya* gives Udifarúnas* as the Yunáni name, and Kanabira as the Syrian, and also mentions a number of cant terms which are applied to it, such as Wark-el-khyál, Hashish, Hashishat-el-fukará, Arsh-numá, Chatr-i-akhzar, &c. *Charas* is described, and the practice of smoking it. The Bengal-grown hemp is said to be less intoxicating than that grown in more Northern climates. Hempseed is called in Persian Shahdánah," royal seeds." The leaves are made into Sherbet and conserves for intoxicating purposes. The properties of hemp are described as cold and dry in the third degree, that is, stimulant and sedative, imparting at first a gentle reviving heat, and then a refrigerant effect, the drug at first exhilarates, improves the complexion, excites the imagination, increases the appetite, and acts as an aphrodisiac; afterwards its sedative effects are observed—if its use is persisted in, it leads to indigestion, wasting of the body, melancholy, impotence and dropsy.

Mirza Abdul Razzak considers hemp to be a powerful exciter of the flow of bile, and relates cases of its efficacy in restoring appetite, of its utility as an external application as a poultice with milk in relieving hæmorrhoids, and internally in gonorrhœa, to the extent of a quarter drachm of bhang.

Charas is only mentioned in comparatively recent medical works. The word is said to be derived from the Sanskrit चर्म

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* Some such word may have been manufactured by the Syrian monks in the Middle Ages, possibly from ἐῦ and *διαφέρω* as an equivalent to the Sanskrit 'Vijaya.'

a skin, but it occurs in Persian with the primary signification of a piece of leather or cloth, the four corners of which are tied up so as to form a wallet, such as beggars carry; in Hindi it signifies a leather bag for holding water, &c. The Charas collected in Central Asia is stored in leathern bags by the cultivators. Among European writers in the East, Rheede and Rumphius figure and describe the Indian plant; the latter states that the kind of mental excitement it produces depends upon the temperament of the consumer. He quotes a passage from Galen, lib. I. (*de aliment. facult.*), in which it is asserted that in that great writer's time it was customary to give hempseed to the guests at banquets, as a promoter of hilarity and enjoyment (the seeds are still roasted and eaten in the East). Rumphius adds, that the Mahometans in his neighbourhood frequently sought for the male plant from his garden, to be given to persons afflicted with virulent gonorrhœa or with asthma, and the affection which is popularly called "stitches in the side." He tells us, moreover, that the powdered leaves check diarrhœa, are stomachic, cure the malady named *Pitao*, and moderate excessive secretion of bile. He mentions the use of hemp smoke as an enema in strangulated hernia, and of the leaves as an antidote to poisoning by orpiment.

In the *Bulletin de Pharmacie* (1810, p. 400), we find it briefly described by M. Rouyer, apothecary to Napoleon, and member of the Egyptian Scientific Commission, in a paper on the popular remedies of Egypt. With the leaves and tops, he tells us, collected before ripening, the Egyptians prepare a conserve, which serves as the base of the *berch*, the *diasmouk*, and the *bernaouy*. Hemp leaves reduced to powder and incorporated with honey, or stirred with water, constitute the *berch* of the poor classes.

Ainslie notices *Májún*, a confection made with hemp leaves to be used as a sweetmeat, the composition of which varies in different parts of the East, and to which are often added other intoxicating drugs. O'Shaughnessy in the *Bengal Dispensatory* 1842 gives a detailed account of its preparation in Calcutta.

The medicinal properties of Cannabis have now been investigated by many European physicians in India. O'Shaughnessy tried it with more or less success in various diseases, especially in tetanus, hydrophobia, rheumatism, the convulsions of children and cholera. Subsequent experience has confirmed the value of the drug as a remedy in tetanus and cholera. In the former disease we have obtained most satisfactory results, large doses are required, and the patient must be kept under the influence of the drug for some days.

In cholera its action may be compared with that of opium; it is most likely to be successful when resorted to early in the disease. People suffering from painful chronic diseases, such as rheumatism, are completely relieved of their pains by hemp, but as the effects of the drug go off, the pains return; some of O'Shaughnessy's patients became cataleptic whilst under its influence. Christison, speaking of Indian Hemp, says:—"I have long been convinced, and new experience confirms the conviction, that for energy, certainty, and convenience, it is the next anodyne, hypnotic and antispasmodic, to opium and its derivatives, and often equal to it."

Among the "*special opinions*" collected by Dr. Watt for the *Dict. of the Econ. Prod. of India*, we observe that Dr. S. J. Rennie recommends the tincture in doses of from 15 to 20 minims three times a day in acute dysentery, and states that he, as well as other medical officers, obtained excellent results with it. Dr. J. E. T. Aitchison states that the oil of the seeds, known as *Kandir yak* in Turkistan, is used in Kashmir as a liniment for rheumatic pains. Others notice it as having valuable narcotic, diuretic and cholagogue properties. (*Op. cit.*, vol. ii., p. 124.)

A. Aaronson states in the *British Journal of Dental Science*, that the tincture as a local anæsthetic is perfectly satisfactory. He has extracted with its aid as many as twenty-two teeth and stumps at one sitting. His plan is to dilute the tincture some three or five times, according to the probable duration of the operation. The diluted tincture is then applied on cotton wool to cavities, if such exist, and also about the gums of the affected teeth. The beaks of the extracting forceps are also, after being warmed, dipped in the tincture. In cold weather it is best to dilute the tincture with warm water. His patients acknowledge the immunity from pain they enjoyed during the operations, and all expressed surprise and pleasure at the simplicity of the performance.

Tannate of cannabin has recently been recommended as a hypnotic. Cannabis appears capable, directly or indirectly, of causing uterine contraction, as in many cases of uterine hæmorrhage; and it is also said to provoke this act during labour with as much energy as ergot, but with less persistant action.

A recent correspondence in the *Lancet*, anent the variation in action and occasional toxic effects of this drug, has brought from Dr. J. Russell Reynolds an important contribution respecting its clinical value.

In explaining the occasional toxic effects of this drug, Dr. Reynolds says two things must be remembered: first, that, by its nature and the forms of its administration, cannabis indica is subject to great variations in strength. Extracts and tinctures cannot be made uniform, because the hemp grown at different seasons and in different places varies in the amount of the active therapeutic principle. It should always be obtained from the same source, and the minimum dose should be given at first, and gradually and cautiously increased. The second important fact to keep in view is, that individuals differ widely in their relations to various medicines and articles of diet—perhaps to none more than to substances of vegetable origin, such as tea, coffee, ipecacuanha, digitalis, nux vomica, and the like. In addition to the purity of the drug, the possibility of idiosyncrasy must be borne in mind as calling for caution in giving Indian hemp. By gradually increasing the dose and habituating the organism to its use, the use of cannabis indica may be pushed to 3 or 4 grains of the extract at a dose with positive advantage. But in Dr. Reynolds' experience 1 grain would bring about toxic effects in the majority of healthy adults; and ¼ of a grain has done the same, but never ⅕, which is the proper amount with which to begin the use of the drug among grown persons, ⅒ of a grain being the proper initial dose for children. The best preparation for administration is the tincture—1 grain to 20 or 10 minims—dropped on sugar or bread. The minimum dose should be given, as before stated, repeated every four or six hours and gradually increased every third or fourth day, until either relief is obtained or the drug is proved useless. With such precautions, Dr. Reynolds states he has never met with toxic effects, and rarely failed to ascertain in a short space of time the value or uselessness of the drug.

Its most important results are to be found in the mental sphere; as, for instance, in Senile Insomnia, with wandering. An elderly person (perhaps with brain softening), is fidgety at night, goes to bed, gets up, thinks he has some appointment to keep, that he must dress and go out. Day, with its stimuli and real occupations, finds him quite rational again. Nothing can compare in utility to a moderate dose of Indian hemp at bedtime—¼ to ⅕ of a grain of the extract. In alcoholic subjects it is uncertain and rarely useful. In Melancholia it is sometimes serviceable in converting depression into exaltation; but unless the case has merged into senile degeneration, Dr. Reynolds does not now employ cannabis indica. It is worse than useless in any form of mania. In the occasional night restlessness of general paretics and of sufferers from the "temper disease" of Marshall Hall, whether children or adults, it has proved eminently useful.

In painful affections, such as Neuralgia, Neuritis, and Migraine, Dr. Reynolds considers hemp by far the most useful of drugs, even when the disease is of years' duration. In neuritis the remedy is useful only in conjunction with other treatment, and is a most valuable adjunct to mercury, iodine, or other drugs, as it is in neuralgia when given with arsenic, quinine, or iron, if either is required. Many victims of diabolical migraine have for years kept their sufferings in abeyance by taking hemp at the threatening or onset of the attack. In sciatica, myodynia, gastrodynia, enteralgia, tinnitus aurium, muscæ volitantes, and every kind of so-called hysterical pain, cannabis indica is without value. On the other hand, it relieves the lightning pains of Ataxia, and also the multiform miseries of the gouty, such as tingling, formication, numbness, and other paræsthesiæ.

In clonic spasm, whether epileptoid or choreic, hemp is of great service. In the Eclampsia of children or adults, from worms, teething (the first, second, or third dentition), it gives relief by itself in many cases. Many cases of so-called Epilepsy in adults—epileptoid convulsions, due often to gross organic nerve-centre lesions—are greatly helped by cannabis indica, when they are not affected by the bromides or other drugs. Take, for instance, violent convulsions in an overfed man, who is attacked during sleep a few hours after a hearty supper, the attacks recurring two or three times an hour for a day or two, in spite of "clearing the primæ viæ," or using bromine or some other classic drug. These attacks may be stopped at once with a full dose of hemp. In brain tumours or other maladies in the course of which epileptoid seizures occur, followed by coma, the coma being followed by delirium,—first quiet, then violent—the delirium time after time passing into convulsions, and the whole gamut being repeated, Indian hemp will at once cut short such abnormal activities, even when all other treatment has failed. In genuine epilepsy it is of no avail. In cases where it has seemed to do good, the author doubts the correctness of the diagnosis, and suspects organic lesion or eccentric irritation. In tonic spasms, such as torticollis and writers' cramp, in general chorea, in paralysis agitans, in trismus, tetanus, and the jerky movements of spinal sclerosis, cannabis indica has proved absolutely useless. At the same time, it is most valuable in the Nocturnal Cramps of gouty or old persons, in some cases of Spasmodic Asthma, and in simple Spasmodic Dysmenorrhœa. Thus it will be perceived that for the relief of suffering, quite apart from a curative effect, hemp must ever be held in high esteem, and ranked with the poppy and with mandragora. (*Medical Annual*, 1891.)

Physiological action.—Like some other narcotics, Indian hemp, when given by the stomach to carnivorous animals, produces its characteristic effects, but graminivorous animals and fish exhibit only vacillating movements and a dull aspect. Upon man its action varies with the individual's temperament and tendencies. Some it inspires with pugnacity, others it inclines to dreamy contemplation, to motiveless merriment, or to maudlin sensibility; some it makes unnaturally active and restless, and plunges others in a drowsy stupor; but more than any other agent, not even excepting belladonna, it perverts the natural perception of objects and their normal condition and relations. Time, distance, and sound are especially apt to form the subjects of the hallucinations caused by this drug. As in dreams, the events of days or weeks may be compressed into an actual period of a few minutes, objects near at hand may seem to form a limitless perspective, and whispered tones may have the reverberation of thunder. These and an infinite variety of fantastic pictures are evoked by smoking the drug, as it is generally employed in Asia, associated with opium. During its influence the physical condition of the experimenter exhibits changes in acceleration of the pulse, warmth of skin, restless muscular movements, more or less insensibility to touch and pain, and sometimes impaired power of locomotion, the limbs feeling as if weighted with lead. In one reported case a diffused vesicular eruption was attributed to this medicine. (*Hyde.*) It does not increase, but, on the contrary, impairs, the venereal propensity and power. The habitual use of cannabis in excessive doses causes the face to become bloated, the eyes injected, and the limbs weak and tremulous; the mind grows imbecile, and ultimately death by marasmus is apt to occur. Acute poisoning by large doses is marked by various and dissimilar symptoms in different cases. In some there is loss of consciousness, with collapse or stupor, insensible pupils, a pale, clammy, and insensible skin, extreme debility, and a small, feeble pulse. In others a cataleptic condition, spasms, or convulsions occur, and in all there is marked anæsthesia. The last-named effect led to the use of cannabis by the Chinese in certain surgical operations. (*Stillé and Maisch.*)

Collection.—The flowering tops of the female plant are collected, and, after having been allowed to wither in the open air for about 48 hours, are arranged on a mat so as to form a circle, and are trodden upon by a number of men, linked together by resting their arms across each other's shoulders, who walk round and round; the object being to compress the resinous flower tops into a compact mass. This process is repeated several times after shifting and re-arranging the *Gánja.* In Bengal a round kind of *Gánja* is prepared by rolling the flowering tops under the feet, and afterwards between the palms of the hands. During the manufacture of *Gánja* a quantity of powder separates, which is known as *Chúr* or *Rora;* it is collected, mixed with an extract of the plant, and made into round balls about the size of a musket ball, which are used for smoking like *Charas.* A similar preparation is made from the dust of the leaves; it is popularly known as *Charas;* several varieties of it are found in the bazars. True *Charas* is collected in Central Asia by shaking, rubbing, or beating the resinous exudation from the flowering plant; it separates as a greyish powder, which, after being packed in bags, gradually consolidates into an oily resinous mass. The genuine article is rarely to be met with in commerce, that sold in the bazars being largely adulterated by the middlemen in the Punjab with the leaves and dust of *Bhang. Bhang* is made by collecting the leaves and drying them. All of these drugs are obtained from the female plant, which the natives consider to be the male, because it bears the seed; all male plants are carefully extirpated by the *hemp doctor*, a person whose business it is to prune the plants so as to produce the maximum amount of flowering heads.

Description.—*Bhang* consists of the dried leaves, which are of a deep green colour and usually broken, so as to form a coarse powder; the odour is peculiar. The leaves have long petioles and are digitate, with linear-lanceolate, sharply serrated leaflets, tapering to a long smooth point.

Gánja is the name given to the flowering tops of the female plant. The flowers form erect clustered spikes, often 6 to 8 inches long; in the drug, the spikes are compressed, flat or round, glutinous, and of a brownish-green colour; they have a peculiar narcotic odour.

Pure *Charas* is a greenish-brown, moist, resinous mass, having the peculiar odour of the plant, and consists of resin mixed with the hairs and fragments of the leaf. Bazar *Charas* varies much in quality, some specimens being only very partially soluble in spirit, friable, and of an earthy appearance. Sixty grains of the finest Yarkand *Charas* which we examined left, after exhaustion with spirit, only 13 grains of residue, chiefly hairs of the plant.

Chemical composition.—The most interesting constituents of hemp, from a medical point of view, are the resin and the volatile oil. The former was first obtained in a state of comparative purity by T. and H. Smith in 1846. (*Pharm. Journ.*, vol. vi., p. 171.) It is a brown, amorphous solid, burning with a bright white flame, and leaving no ash. It has a very potent action when taken internally, two-thirds of a grain acting as a powerful narcotic, and one grain producing complete intoxication.

When water is repeatedly distilled from considerable quantities of hemp, fresh lots of the latter being used for each operation, a volatile oil lighter than water is obtained, together with ammonia. This oil, according to the observations of Personne (1857) (*Journ. de Pharm.*, vol. 39, p. 48), is amber-coloured, and has an oppressive hemp-like smell. It sometimes deposits an abundance of small crystals. With due precautions it may be separated into two bodies, the one of which named by Personne *Cannabene*, is liquid and colourless, with the formula $C^{18}H^{20}$, the other, which is called *Hydride of Cannabene*, is a solid, separating from alcohol in platy crystals, to which Personne assigns the formula $C^{18}H^{22}$. He asserts that cannabene has indubitably a physiological action, and even claims it as the sole active principle of hemp. Its vapour he states to produce, when breathed, a singular sensation of shuddering, a desire of locomotion, followed by prostration and sometimes by syncope. Bohling, in 1840, observed similar effects from the oil, which he obtained from the fresh herb just after flowering, to the extent of 0·3 per cent.

As to the resin of Indian hemp, Bolas and Francis, in treating it with nitric acid, converted it into *Oxycannabin*, $C^{20}H^{20}N^{2}O^{7}$. This interesting substance may, they say, be obtained in large prisms from a solution in methylic alcohol. It melts at 176° C., and then evaporates without decomposition; it is neutral. (*Pharmacographia.*)

Preobraschensky (*Pharm. Zeitsch. f. Russland*, 1876, p. 705) made a chemical examination of a quantity of *haschisch*, which he brought with him from China, and was enabled, according to his own statement, to separate from it a volatile alkaloid, which he held to be identical with nicotine, and which he believed to be the active principle of cannabis. This, in view of the distinctive and very different action of cannabis, was somewhat remarkable. It is highly probable, as has been suggested by Dragendorff and Marquiss (*Pharm. Zeitung*, 1877), that the *haschisch* used by Preobraschensky was mixed with tobacco, which it often is in Eastern countries.

Louis Siebold and Bradbury reported to the British Pharmaceutical Conference (1881) that, after an elaborate investigation, they had arrived at the conclusion of Dragendorff and Marquiss, and that in the course of their investigation they made the interesting discovery that pure cannabis does actually contain a volatile alkaloid, which does not, however, possess the characters of nicotine. They separated it in very small quantity, obtaining not more than 2 grains from 10 lbs. of Indian hemp. They give it the name of *Cannabinine.* They record no observations as to its physiological action; and they, therefore, leave it doubtful as to whether this volatile alkaloid is the narcotic principle of cannabis. (*Pharm. Journ.*, xii., p. 326.)

Dr. Hay (*Pharm. Journ.*, xiii., p. 998) made a chemical examination of the drug, the results, so far, of which lead him to believe that *Cannabis indica* contains several alkaloids. He says:—"In a future communication I hope to be able to give an exact description of the distinctive characters and toxic action of each. In the meantime, I shall content myself with the description of one which I have obtained in a considerable degree of purity, and one which, rather remarkably, possesses an action similar to that of strychnia. It is evidently, therefore, quite a secondary alkaloid of the cannabis, and reminds one of the thebaine of opium. This alkaloid was obtained from a watery infusion of powdered *Cannabis indica* by treating it with a solution of subacetate of lead, and filtering. To the filtrate was added ammonia, and the precipitate removed by filtration. The filtrate, acidulated with sulphuric acid, was now treated with a solution of phospho-wolframic acid in order to precipitate the alkaloids present. The precipitate, which was fairly abundant, was, after the fluid had been removed by filtration and washing with dilute sulphuric acid and pressing, mixed with barium hydrate and water, which formed an insoluble wolframate and set free the alkaloids. The filtrate was next deprived of its excess of barium by means of a stream of carbonic acid gas and again filtered. The filtrate was at a gentle heat evaporated almost to dryness and acidulated with sulphuric acid, and treated with absolute alcohol. The sulphate of the alkaloids thus formed was partially soluble in alcohol, partly not. It was from the soluble part that the alkaloid in question was procured. The sulphate was converted into a chloride by treatment with barium hydrate, afterwards with carbonic acid to remove excess of barium, and, finally, with hydrochloric acid to neutralization. The chloride was evaporated and treated with absolute alcohol, in which it in part dissolved. From the solution, by addition of excess of carbonate of soda and frequent shaking with ether, an alkaloid was obtained in the form of colourless needle-like crystals.

"The alkaloid was easily soluble in water, soluble also in alcohol, and more slowly soluble in ether and chloroform. It caused tetanus in frogs in exactly the same manner as strychnia, increasing the excitability of the reflex centres of the spinal cord. It did not give a violet colour with sulphuric acid and bichromate of potash. It was, therefore, although similar in action to strychnia, not chemically identical with it. A solution of it in water was precipitated by the various alkaloidal precipitants, platinic chloride, iodide of potassium and mercury, phosphotungstate of soda, phosphomolybdic acid, phosphowolframic acid, &c. Although I obtained the alkaloid from 1 kilo. of cannabis, yet the quantity of it was so small that it was insufficient for an elementary analysis.

"To this alkaloid I propose to give the name of *tetano-cannabine*, as indicative of its action."

The Tannate of *Cannabin* of Merck (*Pharm. Jour.*, xiii., p. 1052), a glucoside contained in Indian hemp, which he has combined with tannin, is a yellowish-brown powder, with a taste of tannin, and a rather agreeable odour ; it is insoluble in water and ether, and only slightly soluble in alcohol; in alkaline solutions it dissolves readily. This substance is said to be free from any admixture of the volatile alkaloid of *Cannabis indica*, not to produce intoxication, and to be useful as a hypnotic; it is said not to derange the digestive and secretory organs like opium, and to be especially valuable in irritable states of the nervous system, but Dr. H. C. Wood has found it to be inert physiologically. Warden and Waddell of Calcutta, although operating on a large quantity of Indian hemp of ascertained activity, were unable to find any evidence of the existence of such a principle as Dr. Hay describes. They further remark that :— "As many of those addicted to the Hashish form of intemperance obtain the intoxicating effects by smoking the plant in a pipe, it is to be expected that destructive distillation of the freshly prepared resin might yield up the active principle. This process was therefore resorted to. By the destructive distillation of freshly prepared alcoholic extract of the plant to which an excess of caustic potash solution had been added, an amber-coloured oil was obtained, which, by exposure to the air or the action of alkalies, rapidly became of a dark reddish-brown colour. This oil had a mildly empyreumatic odour, which was distinctly tobacco-like. Its taste was warm, aromatic, and somewhat terebinthinate. The oil contained phenol, ammonia, and several other of the usual products of destructive distillation.

"The nicotine-like principle contained in this oil appeared to be an alkaloid. It formed salts which evolved a strong nicotine-like odour when acted on by alkalies. But physiologically it was found to be inert, and therefore was evidently not identical with nicotine.

"The oil as a whole was also found to be devoid of any narcotic or irritant qualities. About $\frac{1}{8}$ of an ounce was introduced into the stomach of a cat without producing any sensible effect. These results do not coincide with those of Personne, who asserted that the active principle of the plant resided in the volatile oil. It is just possible that the active principle was decomposed by the high temperature necessary for destructive distillation." (*Ind. Med. Gaz.*, Dec. 1884.)

Kennedy (*Pharm. Record,* vi., p. 304) made a search for nicotine in Indian hemp without success, but obtained indications of the presence of another alkaloid.

E. Jahns (*Archiv. d. Pharm.*, 1887) reported that he had separated from Indian hemp a base which he has identified as *choline,* and points out that this result corresponds fairly with the statement of previous workers, except in respect to the crystallizability of Dr. Hay's alkaloid and solubility in ether. The quantity of choline obtained by the author from different samples varied considerably, but amounted at the most to only $\frac{1}{10}$ per cent.

H. F. Smith (*Amer. Journ. Pharm.*, Aug. 1891), by two entirely different processes, obtained an alkaloid from Indian hemp, which separated from ethereal solutions in the form of a yellowish-green, transparent varnish-like substance. It had a strong, peculiar odour, resembling that of coniine ; was soluble in ether, chloroform, alcohol, and acidulated water, but only slightly so in water ; was alkaline to test paper and capable of neutralizing acids. When dissolved in very dilute H^2SO^4 (1 gtt. in 5 cc.), it gave a clear yellow solution and the following reactions:—

With Mayer's reagent, an abundant white precipitate.
,, $KI+I+H^2O$, an abundant brown precipitate.
,, Phosphomolybdate of soda, an abundant white precipitate.
,, Solution of picric acid, an abundant yellow precipitate.
,, ,, $K^2C^2O^7$, a yellowish-brown precipitate.
,, ,, NH^4OH, a yellowish-green precipitate.
,, ,, NaOH, a yellowish-green precipitate.
,, ,, KOH, a yellowish-green precipitate.
,, ,, KI, a yellowish precipitate.
,, ,, tannic acid, a yellowish-brown precipitate.

Supposing this alkaloid of Indian hemp to be highly poisonous, it is present in so small a quantity as to be of little if any importance therapeutically.

Toxicology.—Lyon says—" In India, Cannabis appears to be seldom, if ever, used for homicidal purposes. Fatal, accidental or suicidal cases have, however, been reported. Cases have also been reported where the drug has, or appears to have, been used for the purpose of facilitating the commission of an offence. Thus Chevers mentions a case which occurred at Ahmednagar, in which a woman, having first drugged with *majun*, a child aged seven, afterwards murdered him for the sake of his ornaments. (*Med. Jurisp.*, p. 225.) Harvey reports a case in which *charas* appears to have been used by a road-poisoner at Amritsar, in order to facilitate theft. (*Beng. Med. Leg. Rep.*, 1870-72, p. 268.) A case is also reported by Dr. Cullen of Hoshangabad, in which *majun* was given to a woman and her daughter, "not with the intention of causing death, but to effect a criminal purpose." In these two females, the symptoms present exactly resembled those of dhatura-poisoning, and it would appear that dhatura is sometimes used as an ingredient of *majun*. (*Lyon, Med. Jurisp.*, p. 260.) Ganja is frequently used as a poison in Southern India, chiefly administered with criminal intent. In a case of dacoity investigated near Madura in 1886, it was found that *ganja* had been given in food served up to some travellers. It is resorted to by the relatives of converts to Christianity in Travancore, to prevent them changing their religion or to punish them for doing so.

Dr. Hové, a Polish *savant*, who was sent out to Bombay by the British Government in 1787-89, speaking of Cannabis, says (p. 141): "I arrived at Mithampoor and waited on the Rajah, who ordered provisions for my people and guards. He also ordered to each person a basinful of a beverage which is called by the inhabitants *Beng*. This is nothing else but a decoction of seeds, and bruised leaves and stalks of the Cannabis, which has, however, such powerful quality, that even the steam where it was served overpowered me in a few minutes, so that I was under the necessity of leaving the room." We have no doubt that Cannabis is much more frequently used in India for drugging people than is generally known.

Commerce.—The sea-borne trade in preparations of hemp is insignificant; a small quantity of *ganja* goes to Europe for medicinal use. The imports by trans-frontier routes do not exceed 2½ lakhs of rupees yearly, and the exports 20 to 25 thousand rupees. As regards internal trade, the total annual revenue transactions (transfers, &c.) amount to about 15 lakhs of rupees. The wholesale cost of *ganja* duty-free is about 4½ annas per lb., and of *bhang* Rs. 8 per cwt. The revenue realised by the Indian Government by the duty on hemp is about 30 lakhs of rupees yearly. For full particulars of the Hemp trade in India, see *Dict. Econ. Prod. of India*, ii., p. 113.

FICUS RELIGIOSA, *Linn.*

Fig.—*King, Fic.* 55, *t.* 67 A, 84u; *Wight Ic., t.* 1967; *Rheede, Hort. Mal. i., t.* 27.

Hab.—India. The root-bark.

FICUS BENGALENSIS, *Linn.*

Fig.—*King, Fic.* 18, *t.* 31, 81c; *Wight Ic., t.* 1989; *Rheede, Hort. Mal. i., t.* 28.

Hab.—India. The root-bark.

FICUS TJAKELA, *Burm.*

Fig.—*King, Fic.* 57, *t.* 70, 84x; *Rheede, Hort. Mal. iii., t.* 64.

Hab.—India. The root-bark.

FICUS GLOMERATA, *Roxb.*

Fig.—*Roxb. Cor. Pl. ii., t.* 123; *Wight Ic., t.* 667.

Hab.—India. The root-bark, fruit, juice, and galls.

Vernacular.—*F. religiosa*, Pipal, Pipar (*Hind., Mar., Guz.*), Aswat, Asud (*Beng.*), Arasa (*Tam.*), Rai, Raiga (*Tel.*), Rangi, Basri (*Can.*). *F. bengalensis*, Bar, Bargat (*Hind., Beng., Guz.*), Vara, Vari (*Mar.*), Ala (*Tam.*), Mari, Peddi-mari (*Tel.*), Aladamara (*Can.*). *F. Tjakela*, Ram-anjir, Pákhar (*Hind., Beng.*), Bassári, Pakri, Lendva (*Mar.*), Jovi (*Tam.*), Jevi (*Tel.*), Kari, Bassári (*Can.*) *F. glomerata*, Gúlar, Umar (*Hind.*), Jagnodumar (*Beng.*), Atti (*Tam.*), Moydi, Atti (*Tel.*), Kulla-kith (*Can.*), Umbara (*Mar.*), Umbro (*Guz.*).

History, Uses, &c.—In the *Káthaka Upanishad* an eternal and cosmogonic Aśvattha or Pippal tree is described; this tree is said to have its roots above and branches below (úrdhvamúlo' vákśakha esho' śvatthah sanátanah); it bears the names of 'seed,' 'brahman,' 'amrita'; the worlds rest upon it; beneath it there is nothing. The wood of the Aśvattha when rubbed against that of the Sami (*Acacia Suma*) engenders fire, which is symbolic of reproduction, the former representing the male and the latter the female energy. At the marriage ceremony of the Hindus, both of these plants are necessary. To this mythic tree which represented the macrocosm, wonderful medicinal properties are ascribed in the Atharvaveda; the medicine chest of the Vedic physician, and the cup to contain the Soma, are to be made of it; its branches are the Vedas. In the *Válakhilya*, a collection of apocryphal hymns in the *Rig-veda*, the marriage of the actual tree with Tulasi is enjoined; it is worshipped on Saturdays in the month of Sravan and on Somvatis or "lunar days." Women perform Pradakshina, "walking round it from left to right," to secure the survival of their husbands and good luck generally, as Savitri, the wife of Satyavan, is said to have recovered her deceased husband by its worship. The thread ceremony and marriage of the tree with the Durva (*Cynodon Dactylon*) is also performed by women. Sacrificial spoons are still made from its wood. *F. religiosa* is the *Budhidru*, or tree of wisdom, of the Jains and Buddhists, who relate that at the birth of the Buddha an enormous Aśvattha sprung from the centre of the universe, an offshoot, no doubt, of the Vedic and cosmogonic tree. In the *Rája Nirghantu* it bears the synonyms of Yájnika "sacrificial," Srimana "fortunate," Vipra "wise," Sevya "worthy of worship," &c. Its root-bark, together with that of the three other species of *Ficus* placed at the head of this article, and the root-bark of the Neem, form the *Panchavalkala* or "five barks," and a decoction of them (panchavalkala kasháya) is much used as a gargle in salivation, as a wash for ulcers, and as an astringent injection in leucorrhœa. The powdered root-bark of the Aśvattha, rubbed with honey, is applied to apthæ and unhealthy ulcers to promote granulation.

F. bengalensis, the Vata or Nyagrodha, has been sometimes confounded with the Aśvattha; both trees bear the synonyms Bahupada "many-footed," and Śikhandin "crested," but the Vata is specially described as Skandaja "born of the trunk," Ava-roha-śáyin "sending down branches," Skanda-ruha "growing from its own trunk," Páda-rohana, &c. In Indian mythology an enormous Vata tree is supposed to grow upon mount Supárśva, to the south of the celestial mount Meru, and to cover eleven yojanas; in the Vishun Purana we find a similar account of the Pippala growing on mount Vipula and covering eleven hundred yojanas. Devaki, when pregnant with Krishna, is said to have taken refuge under a Vata tree from Kansa, who had destroyed her first six children. The tree was a special favorite of the Buddha, and Arrian speaks of the Indian sages as sitting under it. There is one famous tree mentioned in the *Ramayana*, the *Uttara Rama-charitra*, the *Kurma-purana*, and elsewhere, which still grows on an island in the Nerbudda; it is said to have been planted by the sage Kabira some two thousand years ago, and is popularly known as the *Kabir Bar*. Owing to the peculiar growth of these trees, there is no reason why they should not last for an indefinite period.

The figs of the Udumbara (*F. glomerata*) are considered to be astringent, stomachic and carminative, and are given in menorrhagia and hæmoptysis, in doses of one tola of the dried fruit with sugar and honey. The fresh juice of the ripe fruit is used as a vehicle (*Vern.* अनुपान) for metallic preparations. The juice of the root is used as a tonic, is applied to glandular swellings,* and is given in doses of four tolas with cumin and sugar in gonorrhœa. The small blister-like galls, which are common on the leaves, are soaked in milk and mixed with honey as a remedy for pitting in small-pox. This tree bears the synonyms of Yajniya "sacrificial," Pavitraka "purifier," &c., and is much used in Hindu ceremonial. According to the *Grihya Sutra*, a married woman in the fourth month of pregnancy should be rubbed with the fruit to fortify the germ.

F. Tjakela, in Sanskrit Parkati or Parkatin, Supárśva and Plaksha, is the waved-leaved fig-tree, a sacred tree, but of minor importance. It is the Tsjakala of Rheede.

Mahometan and European writers do not add much to our knowledge of the medicinal properties of these trees. Ainslie, speaking of *F. glomerata*, says:—"From the root of the tree, which in Tamil is called *attievayr*, there exudes, on its being cut, a fluid, which is caught in earthen pots, and which the Vytians consider as a Cúlpám (*Tam.*), that is, a powerful tonic, when drank for several days together. This Cúlpám is termed *attie-vayr tannic*." (*Mat. Ind.*, ii., p. 30.)

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* It is interesting to not that the juice of the *F. Sycomorus*, Linn., the *συκομόρος* of Dioscorides, and the جميز (Jumíz) of the Arabs, was used by the Greeks, and is still used in Egypt for a similar purpose, and that both trees have much the same habit. (*Dios.*, i, 148, and *Prosper Alpinus*, p. 20). The Indian Mahometans use *F. glomerata* as a substitute for *F. Sycomorus*.

Ainslie also states that the seeds of *F. religiosa* are supposed to possess cooling and alterative qualities, and quotes the following passage from Bartolomeo's *Voyage to the East Indies*: "Pulverised, and taken in water for fourteen days together, the fruit removes asthma, and promotes fruitfulness in women." The tree is the *Areálu* of Rheede, and the *Arbor conciliorum* of Rumphius. (*Mat. Ind.*, ii., p. 25.)

The white glutinous juice of *F. bengalensis* is applied as a remedy for toothache, and to the soles of the feet when cracked and inflamed. The leaves, after they have turned yellow, are given in the Concan with roasted rice in decoction as a diaphoretic; dose, three leaves.

Description.—*F. religiosa*, a tree.—Leaves long-petioled, ovate, cordate, narrow acuminate, acumen one-third the length of the leaf, entire, or repandly undulated towards the apex; fruit-receptacles axillary, paired, sessile, depressed, size of a small cherry, appearing in the hot season and ripening in the rainy season, purple when ripe.

F. bengalensis, a tree.—Branches spreading very much; lower ones rooting; leaves alternate, ovate, bluntly acuminated, with parallel nerves, paler underneath, entire, downy when young, afterwards smooth; fruit-receptacles axillary, paired, sessile, as large as a middle-sized cherry, appearing and ripening in the hot season, red or yellow when ripe.

F. Tjakela, a tree.—Leaves rather long-petioled, membranaceous, oblong, or sublanceolate-oblong, moderately and acutely acuminated, obtuse or rounded, or subcordate at the base, quite entire, or very slightly repand; fruit small, sessile, twin, globose, smooth, when ripe white.

F. glomerata, a tree.—Trunk crooked, thick, bark of a rusty-greenish colour, rough; leaves alternate, petioled, oblong or broad lanceolate, tapering equally to each end, entire, very slightly 3-nerved, smooth on both sides; racemes compound or panicled, issuing immediately from the trunk or large branches; fruit pedicelled, nearly as large as the common fig, clothed with soft down, purple when ripe. For a full botanical account of the Genus, the reader is referred to Dr. G King's "*Species of Ficus.*"

Chemical composition.—The bark of *F. religiosa* contains 3·8 per cent. of tannin, that of *F. racemosa* 14·1 per cent., and that of *F. bengalensis* 10·9 per cent. The air-dried bark of *F. racemosa* yields 12·2 per cent. of ash, that of *F. bengalensis* 8·05 per cent., and that of *F. religiosa* 11·7 per cent. The tannin gives a green precipitate with ferric salts. There is nothing else of interest in these barks, except caoutchouc and wax.

FICUS CARICA, *Linn.*

Fig.—*Woodv., t.* 244; *Steph. & Ch., t.* 154; *Reich. Ic. Fl. Germ. xii., t.* 659. The Fig (*Eng.*), Figue (*Fr.*).

Hab.—Persia. Cultivated in India. The fruit.

Vernacular.—Anjir (*Hind., Guz., Mar., Beng.*), Shimai-atti, Tén-atti (*Tam.*), Shima-atti, Téne-atti (*Tel.*), Shime-atti (*Can.*).

History, Uses, &c.—The Fig holds much the same place in the mythology of the West as the *Pipal* and *Bar* do in Indian mythology. It has been regarded from prehistoric times as an anthropogonic tree and valued for its nutritious fruit. It is frequently mentioned in the sacred books of the Hebrews and by early Greek and Latin writers. Hippocrates notices it in several places as having aperient, emollient and nutritious properties, and as being useful as an article of diet in phlegmatic affections. Figs were used in lustration by the Greeks. The celebrated *Ficus ruminalis* of Rome, appears, like the Indian Ásvattha (*F. religiosa*), to have been regarded as a cosmogonic tree. Pliny gives the following description of it:—"Colitur ficus arbor in foro ipso ac comitio Romæ nata, sacra fulguribus ibi conditis. Magisque ob memoriam ejus quæ nutrix fuit Romuli ac Remi conditoris appellata, quoniam sub ea inventa est lupa infantibus præbens *rumen* (ita enim vocabant *mammam*), miraculo ex acre juxta dicato, tamquam in comitium sponte transisset." In the worship of Dionysus, the fig played an important part; the phallus was made of its wood and the fruit was a necessary offering to the god. In the early Christian mythology this phallic tree became accursed, the tree of Judas, &c., and was supposed to be haunted by evil spirits, and the early Italian missionaries in India gave the name of *albero del diavolo* to the Indian fig-tree. For a full account of the myths and superstitions connected with the fig, we must refer the reader to De Gubernatis. (*Myth. des Plant.*, ii., 137—143.) The fig appears to have been known to the Arabs and Persians from prehistoric times. Aitchison (*Botany of the Afghan Delimitation Commission, Trans. Lin. Soc.*) gives an interesting account of the wild fig-tree of Eastern Persia, and Abu Hanifeh, author of the *Book of Plants*, describes the fig as wild in the Saráh, and commonly eaten by the people in its fresh state, and also dried and stored. In the chapter of the Koran entitled "The fig" (التين), it is mentioned along with the olive. God, say the commentators, swears by these two fruits, because of their great uses and virtues, for the fig is wholesome and easy of digestion, and medicinally good to carry off phlegm, and gravel in the kidneys or bladder, and to remove obstructions of the liver and spleen, and it cures piles and the gout, &c.

The cultivation of this tree in India was introduced by the Mahometans, and is now carried on by both Mahometans and Hindus in many parts of the country; caprification is not practised, and all the fruit which we have seen is much inferior to that grown in Europe. Two varieties, the purple and the green, are cultivated in the Bombay Presidency, where the area under fig cultivation is about 300 acres; the Hindus are fond of the fruit, which they consider to be cooling and nutrient; they also use the unripe fruit as a vegetable. The fruit of *F. Roxburghii* as grown at Alipore, near Calcutta, attains a large size, and when ripe is of a bright red; it is not unpalatable.

Dried figs were brought to India from Arabia and Persia, long before the tree was cultivated in the country, by the early Arab traders to the Western Coast, and overland from Persia; they are of a small kind, pressed flat and strung upon a string made of camels' hair; when well washed and stewed in syrup they are not unpalatable. We have frequently used them for the preparation of confection of senna with satisfactory results.

Description.—A fig consists of a thick, fleshy, hollow receptacle of a pear-shaped form, on the inner face of which grow a multitude of minute fruits. This receptacle, which is provided with an orifice at the top, is at first green, tough and leathery, exuding when pricked a milky juice; on maturity it becomes soft and juicy, and the milky juice is replaced by a saccharine fluid. The orifice is surrounded, and almost closed by a number of scales, near which, and within the fig, the male flowers are situated, but they are often wanting, or are not fully developed. The female flowers stand further within the receptacle, in the body of which they are closely packed; they are stalked, have a five-leafed perianth and a bipartite stigma. The ovary, which is generally one-celled, becomes when, ripe; a minute, dry, hard nut, popularly regarded as a seed. (*Pharmacographia.*)

Chemical composition.—Exclusive of the achenes, which, together with the cellular tissue, Bley (1831) found to constitute about 15 per cent. of the weight of figs, he obtained 16 per cent. of water, 62·5 per cent. of sugar (glucose), the remainder being gum, fat, and saline constituents. The mean of five analyses of dried figs reported by König affords the the following percentage results:—

Water	31·20
Albuminoids	4·01
Sugar	49·79
Ash	2·86

The anhydrous figs contained ·92 per cent. of nitrogen and 2·26 per cent. of sugar.

A. Hansen in 1886 found that the latex of *Ficus Carica* contained principles capable of effecting four fermentative changes; they peptonise albuminoids in the presence of either alkalies or acids, act on starch like diastase, and coagulate the casein of milk. The products of digestion are the same as with pepsin, although the two ferments are not identical. In 1890,

U. Mussi separated from fig sap a digestive ferment which he named "cradina," from *krade* (κράδη), the name given by the Greeks to the part of the fig with which they associated the digestive property. It contains nitrogen, and differs from pepsin in maintaining its digestive power in an alkaline liquor, and from papain or papayotin in being insoluble in water, not precipitated from solution by alcohol or lead acetate, and in its activity not being diminished in the presence of hydrochloric acid.

The following species of Ficus are also considered to have medicinal properties :—

Ficus Rumphii, *Bl. King Fic.* 54, *t.* 673, 84t; *Wight Ic., t.* 640,—Pákar (*Hind.*), Gai-asvat (*Beng.*), Pair, Ashta (*Mar.*), a native of the hill slopes of North-Western and Central India, is a tree having much the appearance of the Pipal; leaves on very long petioles (6 to 8 in.), broad-cordate, with a short and sudden acumination, rather membranaceous with waved margins, finely reticulated beneath, perfectly smooth; fruit paired, sessile, round, smooth, black, of the size and appearance of a black cherry. The juice is used in the Concan to kill worms, and is given internally with turmeric, pepper and ghí, in pills, the size of a pea, for the relief of asthma; it causes vomiting. The juice is also burned in a closed vessel with the flowers of *Mudar*, and four gunjás' weight of the ashes mixed with honey is given for the same purpose.

Ficus retusa, *Linn. King Fic.* 50, *t.* 61, 62, 84p; *Wight Ic., t.* 642,—Kámrup (*Hind., Beng.*), Yerra-juvi (*Tel.*), Pilaka (*Can.*), Jili (*Tam.*), Nandruk (*Mar.*), a native of the base of the Eastern Himalaya and of the Deccan Peninsula, is used medicinally in rheumatism, the leaves and bark being pounded and applied as a poultice. In the Concan the following prescription is in use for flatulent colic :—Take of Nandruk leaf-juice, Tulsi leaf-juice, and ghí, equal parts; boil until all the water has evaporated; do this again 21 times with fresh quantities of the juice of the two plants; the residuum may then be applied to the belly, and fomentation with a hot brick be practised.

Rheede notices a similar use of the plant. (*Hort. Mal.*, iii., t. 55.) The juice of the bark has a reputation in liver disease; dose, 1 tola in milk.

Ficus asperrima, *Roxb. Wight Ic.*, *t.* 633,—Kál-umar (*Hind.*), Kara-karbuda (*Tel.*), Khargas (*Can.*), Kharvat, Kharoti (*Mar.*), a native of Central India and the Deccan Peninsula, remarkable for the roughness of its leaves, which are used as sand paper by the natives, and have been given the name of *Folhas da raspa* by the Portuguese, is a small tree with ovate, alternate, very rough leaves of a pale green colour, at the apex of the petiole and in the axils of the leaf-veins there are small shining green glands as in *F. hispida,* except that the glands are more completely in the axils, and appear closed, whereas in the latter plant they have a distinct stoma. The leaves owe their roughness to the presence of calcareous hairs. Both the juice of the plant and the bark are well-known remedies for glandular enlargements of the abdomen, such as liver and spleen. Rheede says that the root taken in the morning with palm vinegar "viscerum ardorem compescit." The bark is brown, scabrous and brittle, and has a bitter and astringent taste.

Chemical composition.—The bark contains a crystalline principle soluble in alcohol, which is precipitated by alkaloidal reagents, and is not coloured by the stronger acids. It also contains an organic acid precipitated by gelatine, and darkened in colour by ferric chloride. The ash of the air-dried bark afforded 18·4 per cent. of white calcareous ash.

Ficus hispida, *Linn. Wight Ic.*, *tt.* 638, 641, the *F. dæmonum* of Kœnig, is the Kakodumbara or Kakodumbarika, "crows' fig," of Sanskrit writers, and is stated in *Madanpal's Nighanta* to have the same properties as *F. glomerata.* It is the Kát-gular of Hindustan, the Kako-dumar of Bengal, the Bokhera or Dhed-umbar of Bombay, and the Pe-attis of Madras. Rheede says that the fruit boiled in goat's milk is used in hepatic obstruction; it has been brought to notice by Mr. M. Sheriff on account of its emetic properties. The shrub has opposite, cuneate, oblong leaves, which are scabrous above and downy beneath. The fruit is like a small fig and very downy; it usually grows from the stem near or beneath the ground; an interesting description of it by Dr. G. King forms one of the series of *Scientific Memoirs by Medical Officers of the Army of India*, published at the Government Printing Press, Calcutta. In Bombay and the Concan the powdered fruit heated with a little water is made into a *lep*, or poultice, which is applied to buboes, which it either disperses or brings rapidly to maturity. The fruit is also given to milch-cattle to dry up their milk.

The emetic properties of the plant are due to the presence of saponin.

Chemical composition.—The bark contained 2·1 per cent. of tannin, and some wax and caoutchouc-like substance. No alkaloid was discovered, but a glucosidal principle, having the properties of saponin, was separated from a decoction by barium hydrate. The air-dried bark yielded 13·6 per cent. of mineral matter on incineration.

Ficus gibbosa, *Bl. King Fic.* 4, *t.* 2; *Wight Ic.*, *t.* 650, is a native of the bases of the hill ranges throughout India. It is a climbing shrub, and often a tree with a stem as thick as a man's arm; leaves alternate, very shortly petioled, somewhat ovate, suddenly acuminated, very unequally sided, cuneate toward the base; lateral nerves 3 to 4 on each side, prominent, spreading, uniting in arches, pale green, rough, length 3 to 4 inches, sometimes a little toothed on the margin; fruit small. The *Flora of British India* describes four varieties of this plant. In Western India the root-bark is considered to be stomachic and gently aperient. The Marathi name is Dántira, the Telugu names Konda-juvi and Tella-barinka.

Chemical composition.—The bark contains 4·3 per cent. of tannin; besides some colouring matter, a small quantity of an alkaloidal principle was separated from the tincture, having no very characteristic reactions with the strong acids. The ash of the air-dried bark was 15 per cent.

ANTIARIS TOXICARIA, *Lesch.*

Fig.—*Bot. Mag. i., t.* 17; *Wight Ic., t.* 1958; *Bedd. Fl. Sylv., t.* 307. The Upas tree (*Eng.*), Antiar vénéneux (*Fr.*).

Hab.—The Deccan Peninsula, Ceylon. The nuts.

Vernacular.—Chándul, Chándakuda, Sápsúndí (*Mar.*), Nettavil-maram (*Tam.*), Jajhugri (*Can.*), Araya-angeli (*Mal.*).

History, Uses, &c.—"Most exaggerated statements respecting this plant were circulated by a Dutch Surgeon about the close of the last century. The tree was described as growing in a desert tract, with no other plant near it for the distance of 10 or 12 miles. Criminals condemned to die were offered the chance of life if they would go to the Upas tree and collect some of the poison. They were furnished with proper directions, and armed with due precaution, but not more than two out of every twenty ever returned. The Dutch Surgeon Foersch states that he had derived his information from some of those who had been lucky enough to escape, albeit the ground around was strewn with the bones of their predecessors; and such was the virulence of the poison, that " there are no fish in the waters, nor has any rat, mouse, or any other vermin been seen there; and when any birds fly so near this tree that the effluvia reaches them, they fall a sacrifice to the effects of the poison. Out of a population of 1,600 persons, who were compelled, on account of civil dissensions, to reside within 12 or 14 miles of the tree, not more than 300 remained in less than two months. Foersch states that he conversed with some of the survivors, and proceeds to give an account of some experiments that he witnessed with the gum of this tree, these experiments consisting principally in the execution of several women, by direction of the Emperor! Now, as specimens of this tree are cultivated in botanic gardens, it cannot have such virulent properties as it was stated to have; moreover, it is now known to grow in woods with other trees, and birds and lizards have been observed on its branches. It occasionally grows in certain low valleys in Java, rendered unwholesome by an escape of carbonic acid gas from crevices in the ground, and which is given off in such abundance as to be fatal to animals that approach too closely. These pestiferous valleys are connected with the numerous volcanoes in the island. The craters of some of these emit, according to Reinwardt, sulphureous vapours in such abundance as to cause the death of great numbers of tigers, birds and insects; while the rivers and lakes are in some cases so charged with sulphuric acid, that no fish can live in them." (*Treasury of Botany.*)

In Travancore *A. toxicaria* is known as the *sacking tree*, and is not regarded by the natives as poisonous; the same is the case in Coorg, where sacks and even garments are sometimes made from the inner bark. In the Concan and in Canara the bitter seeds are used as a febrifuge, and as a remedy in dysentery, one-third to one-half of a seed being given three times a day.

The use in the Malayan region of a vegetable poison to tip the bamboo arrows which are discharged from a blowpipe, is too well known to need description. To this the name *Upas* is given in Java, and *Ipoh* by the Malays elsewhere. Both words have the same meaning, and, according to Blume, signify poison. There is no doubt that this poison is the produce of *A. toxicaria.* In 1878, Regnault experimented with a poison used by the savages of Tonkin to poison their arrows, and in a communication to the *Société de biologie* he showed that this substance was a powerful heart poison. Baillon identified the leaves from which the poison was prepared as those of *A. toxicaria.* In 1881, Sir Cecil Smith, then Colonial Secretary to the Straits Settlements, forwarded to Kew a bottle of Ipoh poison as well as foliage specimens of the tree from which it was obtained. These were collected by Sir Hugh Low, then British Resident in Perak, at the Plus River. The poison was subjected to a careful examination by Dr. Sidney Ringer, who reported that it was perfectly inert. The plant seemed identical with that collected by Griffith, and both were identified at Kew with the Javanese *A. toxicaria.* In 1888, Chauvet (*Thèse Bordeaux*) examined the arrow poison of Indo-China, and came to the same conclusions concerning its poisonous properties as were arrived at by Regnault in 1878. In 1889, the Straits

Government sent to Kew further specimens of *Ipoh* poison, which were again examined by Dr. Ringer with entirely negative results. Botanists were not, however, unprepared for this result. The Dutch botanist, Blume, in his fine work '*Rumphia*,' has given an elaborate account of the Javanese *Upas* and of the tree which yields it (pp. 46—59, tt. 22, 23), but he points out that Rumphius, our earliest authority on Malayan botany, distinguished two kinds of Upas trees, which he termed *Arbor toxicaria femina* and *mas* respectively. Rumphius's *femina* was destitute of any poisonous qualities, and Blume has described it as a distinct species under the name of *A. innoxia* (*Rumphia*, pp. 171—173, t. 54). He received specimens from the island of Timor, where Spanoghe* found that the sap was destitute of any poisonous effect on animals; he also gives Celebes as a locality for the innocuous plant. Other botanists have not, however, found themselves able to attach much weight to the distinctive characters pointed out by Blume, and there can be no doubt that what weighed principally in his mind was the remarkable difference in the properties of the two forms. Species are, however, made by botanists on structural (morphological) differences and not on physiological. In the same species of *Cinchona* it is now known that there are the widest differences in the amount and even nature of the alkaloids which can be extracted from the bark. An equally striking, and even better known instance of differences in properties, unaccompanied by any difference in external characters, is afforded by two well-known British umbelliferous plants, *Œnanthe crocata* and *Cicuta virosa*, which Sir R. Christison found to be innocuous when grown near Edinburgh.

Brandis in his '*Forest Flora*' has identified with *A. innoxia* the *A. saccidora* of South-west India. According to Beddome, this is "the largest tree of the vergreen forests of the Western Ghauts, and the hills betweem tnem and the Coast." Sacks are made of the thick woolly fibrous inner bark. The method is thus described by Graham:—"A branch is cut corresponding to the length and diameter of the sack wanted, soaked a little, and then beaten with clubs till the fibre separates from the wood. This done, the sack formed of the bark is turned inside out, and pulled down, until the wood is sawed off, with the exception of a small piece left to form the bottom of the sack, which is carefully left untouched."

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* Spanoghe's account of the innocuous Upas of Timor is printed, together with that of Leschenault on the virulent kind, in Hooker's *Companion to the Botanical Magazine*, Vol. I., pp. 308—317.

Brandis remarks (*l. c.*, p. 427):—"Another species of the same genus (*Myah seik*, Burm.) is found in the dense evergreen forests of the Thoungyeen Valley. In Tenasserim the juice is used by the Karens to poison arrows, but the poison does not seem equal in its effects to that of the famous Upas tree of the Indian Archipelago." Mason refers the Pegu Upas to *A. ovalifolia*, a very large timber tree scattered in the forests from Mergui to Toungoo. The milky juice is intensely bitter, and when swallowed produces sore-throat. Arrows that have been smeared with it and hung exposed to the air, lose their power to produce death, and there is said to be a difference in the virulence of the poison at different times of the year. Nothing more seems to be known of the tree which yields the Karen arrow poison, but it is very probably referable to *A. toxicaria*, and Gamble (*Manual of Indian Timbers*, p. 332) refers the Burmese name *Myah seik* to that species. (*Archives de Physiologie*, 3, 1891; *Kew Bulletin*, 50, 1891.)

In 1891, MM. E. Boinet and E. Hedon examined the arrow poison used by the Muongs of Tonkin. They found the quantity of the poison on each bamboo arrow to be about half a gram of a brownish substance soluble in water. Three drops of a solution of 0·50 gram of the poison in 10 grams of water placed upon a frog's heart arrested the pulsations in seven minutes, and a subcutaneous injection of one centigram of the poison proved fatal to a guinea pig. From twenty experiments, it was found that one centigram per kilo body-weight was rapidly fatal to the animals experimented upon.

The authors arrive at the following conclusions:—

1*st*.—That the poison has no appreciable effect upon the nervo-muscular or central nervous system.

2nd.—The breathing is accelerated for a few minutes after the injection of the poison, but afterwards the number of respirations gradually decreases until death takes place.

3rd.—The final effect of the poison is to stop the heart in systole.

In the poisoned frogs the ventricle was contracted, empty, hard and white. In the mammal the left ventricle was smaller and harder than usual, the right ventricle less contracted and full of dark blood. Before final stoppage the heart symptoms may be divided into several stages. In mammals, at a certain period after the injection of the poison, a sudden want of rythm was observed, the heart beating very irregularly. Afterwards the pulsations became more and more feeble, with occasional stronger contractions, and finally periods of great depression alternating with periods of stronger pulsation were observed. In all cases a few auricular pulsations occurred after stoppage of the ventricles. It was remarked also that pulsation could be re-induced by mechanical or electrical stimulation of the heart muscle.

In the frog the first effect of the poison on the heart is a very marked doubling of the pulsations. Whereas in the normal condition the auricular contraction immediately precedes the ventricular, and is shown on the pulse tracing by a slight hitch in the curve of the total pulsation; in the poisoned animal the two pulsations are separated by a marked interval, and finally the auricular curve becomes so marked as to equal or even exceed in size the gradually decreasing ventricular curve.

In the second stage the ventricle only contracts once to several auricular contractions, that is, it only contracts when it has become sufficiently distended with blood to excite contractions.

In the last stage the strength of the auricular contractions gradually decreases, the ventricle remaining immovable, empty, and contracted. The authors conclude that the poison acts upon the intracardiac ganglia and not upon the central nervous system.

The poison, we are informed, is prepared by the natives of Tonquin from the leaves of *A. toxicaria*, and experiments made by the authors with the leaves of that plant prove clearly that they are the only active ingredient in the arrow poison. (*Archives de Phys.*, 1891, p. 373.)

A still more recent investigation of the Ipoh poison by Mr. L. Wray, the Curator and State Geologist of Perak, has been published in the *Perak Gazette*. He says:—The Samangs get the sap from the tree by scoring the bark. The sap is heated on a spatula till evaporated, leaving a dark gummy substance in which the arrows are dipped; 3½ ounces of sap will do for poisoning 100 arrow points. The sap was bitter and biting in taste and decidedly acid to test paper; when exposed to the air it darkens to a brown colour, and yields when dried 29 per cent. of Ipoh. If this substance is placed on a glass slide and examined under a microscope it is seen to contain numerous crystals of antiarin. Some fruiting specimens of the Ipoh were sent to Kew in 1883, and were pronounced to be identical with the Javan specimens of *A. toxicaria.* With reference to the two kinds of Upas distinguished by Blume as *Arbor toxicaria femina et mas*, the latter word in Malay means "gold"; it is so called from the golden colour of the inner bark. In the innocuous variety, so say the Samangs, the inner bark is blackish coloured, and so they distinguish the poisonous from the non-poisonous trees. They have never mixed arsenic with the sap. One fluid ounce of Ipoh sap was found to yield 10·85 grains of antiarin or 2·482 per cent. The dried Ipoh poison, of which the sap contains 29 per cent., therefore has 8·56 per cent. of antiarin in it. 0·086 of a grain of the dried poison is enough to kill an animal weighing 20 lbs., when introduced into the circulation. Fowls and pheasants are proof against the poison, but a cat struck with a poisoned dart died within 19 minutes. Mr. Wray's Report has since been published in the *Kew Bulletin* for October and November 1891.

Description.—The nuts are sub-globular, the size of a marble, of a light-brown colour, and have a slightly prominent umbilicus; they are enclosed in a sweet greenish-yellow pulp, forming a small one-seeded fig with a rich purple bloom. The shell is thin and fragile, the kernel, loose inside the shell, is of the size of a large pea, brown, sub-globular, rugose, especially upon the flatter side; substance hard and very bitter.

Chemical composition.—When the sap of the tree is exhausted with boiling alcohol, a mixture of vegetable albumin, gum and wax remains undissolved, while a solution is formed, which throws down, on cooling, wax, antiar-resin, and albumin. On removing the sediment and evaporating, more resin and wax are deposited, and the solution dries up at last to an extract, from a solution of which in boiling water *Antiarin*, $C^{14}H^{20}O^{5}+2H^{2}O$, amounting to 3·5 per cent. of the dried sap, crystallises. The crystals are purified by washing and recrystallisation. Antiarin forms splendid silvery laminæ resembling malate of lime.

The flakes which separate from the alcohol after boiling it with the sap of *A. toxicaria*, consist of *Antiar-resin*, $C^{32}H^{24}O^{2}$, which may be obtained white by re-solution in boiling alcohol; when dry it has a glassy fracture, but becomes pasty if warmed. It is not poisonous, whilst antiarin causes death if introduced into the circulation in minute portions. (*Mulder in Gmelin's Handbook*, Vol. XVI., p. 217.)

The wax deposited on cooling from an extract of the juice prepared with hot alcohol, and purified by boiling with water, is white and brittle, softening at 30°, and melting at 35°, sp. gr. 1·016 at 20°. It is decomposed by nitric acid, blackened by sulphuric acid, and not affected by hydrochloric acid or potash-ley. It is soluble in alcohol and ether, especially on boiling. Average composition 77·29 per cent. Carbon, 11·71 H, and 11 O. (*Ibid.*, Vol. XVIII., p. 158.)

The seeds of the Indian plant, collected in Savant Vádi, contain a crystalline principle, very bitter and poisonous, resembling, if not identical with, antiarin. It is soluble in water, alcohol, and very slightly in ether. It gives a reddish-brown colour with sulphuric acid, and a yellowish or orange colour with nitric acid. On allowing the dried extract to stand, it does not readily crystallize out, but if the alcoholic extract is dissolved in water, in which it is quite soluble (showing absence of resinous matter), and the solution agitated with crude ether, crystals can be obtained from the decanted ethereal layer. The solution also reduced Fehling's solution. About 2 per cent. of fat, 11·33 of water, and 3·46 of ash were separated from the air-dried seeds.

The juice of **Artocarpus integrifolia,** *Linn.*, the well-known Jack tree, in Sanskrit Panasa, heated over the fire, is a popular cement for joining broken China and stoneware. The deposit from the milky juice is insoluble in water, partly soluble in alcohol, and entirely so in benzol. It is a variety of caoutchouc, and in the natural state can be used as a birdlime, or as a cement for broken articles; after being washed in boiling water it becomes harder, and may be used for all the ordinary purposes of India-rubber. The yellow dye which is obtained from the wood is of a resinous nature, and may be extracted by boiling water or alcohol. The juice of **A. Lakoocha,** *Roxb.*, or one or two of the seeds, is a popular purge in Bengal; the tree is the Dahu of Sanskrit writers. Rheede states that the dry leaves and juice of **A. hirsuta,** *Lamk.*, together with zedoary and camphor, are applied to buboes and swelled testicles. The dried juice breaks with a resinous fracture, is only partly soluble in alcohol, wholly soluble in benzol and petroleum ether. The tree yields the Anjelly wood of South India, and is called Ayani in Malabar, where it is very abundant.

MYRICACEÆ.

MYRICA NAGI, *Thunb.*

Fig.—*Bot. Mag.*, *t.* 5727; *Wight Ic.*, *t.* 764, 765.

Hab.—Subtropical Himalaya. The bark.

Vernacular.—Kaiphal, Kátphal (*Hind.*, *Guz.*, *Beng.*), Kaya phala (*Mar.*), Marudam-pattai (*Tam.*), Kaidaryamu (*Tel.*), Marutam-toli (*Mal.*), Kirishivani (*Can.*).

History, Uses, &c.—The bark of this tree is its most valuable product, and is largely exported to the plains. It is called in Sanskrit Katphala, and bears among other synonyms those of Kumuda, Kumbhi-pśki, Sriparnika, Somavalka, and Mahakumbhi. According to the Nighantas, it is useful in diseases caused by deranged phlegm, such as fever, asthma, gonorrhœa, piles, cough, and other affections of the throat. It is an ingredient in numerous formulæ for these diseases, such as the *Katphaladi churna,* for which Sarangadhara gives the following prescription:—Take of the bark of *M. Nagi,* tubers of *Cyperus rotundus* (Mustaka), root of *Picrorhiza Kurrooa* (Katuki,), *Curcuma Zedoaria* (Sati), galls of *Pistacia integerrima* (Karkata-sringi), and root of *Saussurea Lappa* (Kushta), equal parts; powder and mix. This powder is given in doses of about a drachm with the addition of ginger juice and honey in affections of the throat, cough and asthma. The powdered bark is used as a snuff in catarrh, and mixed with ginger as an external stimulant application in cholera, &c.

Under the names of Dár-shishaán, Kandúl, and Úd-el-bark, Mahometan writers state that the bark is resolvent, astringent, carminative, and tonic; that it cures catarrh and headaches; with cinnamon they prescribe it for chronic cough, fever, piles, &c. Compounded with vinegar it strengthens the gums and cures toothache; an oil prepared from it is dropped into the ears in earache. A decoction is a valuable remedy in asthma, diarrhœa and diuresis; powdered or in the form of lotion the bark is applied to putrid sores; pessaries made of it promote uterine action. The usual dose for internal administration is about 60 grains. *Duhn-el-kandúl,* an oil prepared from the flowers, is said to have much the same properties as the bark. We have never met with it, nor does it appear to be known in commerce.

Description.—Bark half an inch thick, externally scabrous, pitted from the separation of pieces of suber, of a mottled rusty-brown and dirty white colour, suber warty; substance of bark and inner surface of a deep dull red colour; when soaked in water it produces a deep red solution; taste strongly astringent.

Microscopic structure.—Within the suberous layer is a remarkable stratum of stony cells; the parenchyma throughout is loaded with red colouring matter, and permeated by large laticiferous vessels, from which a gummy latex exudes when the bark is soaked in water.

Chemical composition.—The bark of *M. Nagi* contains 14 per cent. of tannin, which gives a purplish colour with ferric salts, but the tincture and decoction give a greenish colour owing to the presence of colouring matter in the bark. The ash of the air-dried bark amounts to 7·17 per cent.

When the bark is exhausted by water and the water evaporated, a brittle shining extract is obtained of a reddish-brown colour, which contains 60 per cent. of tannin with some saccharine matter and salts.

Commerce.—The bazaars are supplied from Northern India; about 50 tons of the bark are collected annually in the Kumaon forests. It is always obtainable in native drug shops. Value about Rs. 2 per maund of 41 pounds.

CASUARINEÆ.

CASUARINA EQUISETIFOLIA, *Forst.*

Fig.—*Beddome, Forester's Man., t.* 226. Tinian Pine (*Eng.*), Filao de l'Inde (*Fr.*).

Hab.—East side of the Bay of Bengal. Cultivated elsewhere. The bark, leaves, and seeds.

Vernacular.—Sinyu (*Burm.*), Chouk (*Tam.*), Sarva (*Tel.*), Kásrike (*Mysore*), Aru (*Mal.*), Viláyati-saru (*Mar.*).

History, Uses, &c.—This tree is distributed through Chittagong, Burma, the Malay and Pacific Islands, and Australia, and is much cultivated on the coasts of India. In

Australia it is called the swamp oak. Dr. Bennett (*Gatherings of a Naturalist in Australia*) remarks:—"Their sombre appearance causes them to be planted in cemeteries, where their branches give out a mournful sighing sound, as the breeze passes over them, waving at the same time their gloomy hearse-like plumes." The wood from its red colour is called in the colonies *Beef-wood*, and is much used for fuel, and as a timber on account of its hardness. The bark is astringent, and the ashes of the tree yield a quantity of alkali. The bark is used by the Madras fishermen for dyeing their nets. Rumphius notices the use of a decoction of the bark for a bath in Beri-beri, and of a decoction of the leaves in colic. The pounded seeds, he says, are used as a plaster in headache.

According to Corre and Lejanne (*Mat. Med. et Tox. Colon.*), the bark contains one-fifth of its weight of tannin and one-twelfth of *Casuarine*, resin, and colouring matter. A decoction, extract, tincture and syrup are used by the French in Tahiti, Cochin-China, and the Antilles as an astringent. We have observed that the tree yields an inferior sort of gum, not likely to be of much value on account of its deep colour and insolubility in water.

Description.—Bark never very thick, brittle, breaking with a coarse fibrous fracture, substance very hard, fibrous, and of a pink colour; internal surface striated; external surface covered with a scabrous grey suber, readily separating in flakes, and displaying a thin brown suberous layer closely adhering to the liber; taste strongly astringent; odour not peculiar.

Chemical composition.—The bark yielded 18·3 per cent. of tannic acid, giving a blue-black precipitate with ferric salts, and a bulky precipitate with gelatine. The alcoholic extract contained no alkaloidal principle, but a very small quantity of a crystalline neutral principle was shaken out of the watery solution of the extract by ether; it was not coloured by strong acids.

CUPULIFERÆ.

BETULA UTILIS, *Don.*

Fig.—*Regel Monogr.* 58, *t.* 6, *f.* 13-19; *t.* 13, *f.* 7-14; *Jacq. Voy. Bot.*, *t.* 158. Himalayan Birch (*Eng.*), Bouleau á papier (*Fr.*).

Hab.—Temperate Himalaya, Afghanistan.

BETULA ALNOIDES, *Ham.*

Fig.—*Brand. For. Fl.*, *t.* 56; *Regel Monogr.* 61, *t.* 6, *f.* 32-34; *t.* 13, *f.* 29.

Hab.—Temperate and subtropical Himalaya. The bark.

Vernacular.—Bhujpatar (*Ind. Bazaars*).

History, Uses, &c.—These trees require a brief notice, as the bark, in Sanskrit Bhurjapatra, is much used all over the country for writing medicinal charms on, and is to be found in every druggist's shop. This bark is well-known as the material upon which the ancient Sanskrit manuscripts of Northern India are written. Dr. Bühler, in his account of a tour in Cashmere in search of Sanskrit manuscripts, says:—"The Bhurja MSS. are written on specially prepared thin sheets of the inner bark of the Himalayan birch, and invariably in Sârada characters. The lines run always parallel to the narrow side of the leaf, and the MSS. present, therefore, the appearance of European books, not of Indian MSS., which owe their form to an imitation of the *Talapatras.* The Himalayas seems to contain an inexhaustible supply of birch-bark, which in Cashmere and other hill countries is used both instead of paper by the shop-keepers in the bazaars, and for lining the roofs of houses in order to make them water-tight. It is also exported to India, where in many places it is likewise used for wrapping up parcels, and plays an important part in the manufacture of the flexible pipe-stems used by hukâ-smokers. To give an idea of the quantities which are brought into Srinagar, I may mention that on one single day

I counted fourteen large barges with birch-bark on the river, and that I have never moved about without seeing some boats laden with it. None of the boats carried, I should say, less than three or four tons' weight.

"The use of birch-bark for literary purposes is attested by the earliest classical Sanskrit writers. Kalidâsa mentions it in his dramas and epics; Susruta, Varahâmihira (*circa* 500-550 A. D.) know it likewise. Akbar introduced the manufacture of paper, and thus created an industry for which Cashmere is now famous in India. From that time the use of birch-bark for the purpose of writing was discontinued, and the method of preparing it has been lost. The preparation of the ink, which was used for Bhûrja MSS., is known. It was made by converting almonds into charcoal and boiling the coal thus obtained with *gomûtra* (urina bovis); this ink is not affected by damp or water." (*Journal, Bombay Branch Royal Asiatic Society,* Vol. XII., No. XXXIV. A.)

QUERCUS INFECTORIA, *Olivier.*

Fig.—*Bentl. and Trim., t.* 249 ; *Olivier, Voy. dans l'Emp. Oth. ii.,* p. 64, *Atlas, tt.* 14, 15; *Steph. & Church, t.* 152. Dyers' oak (*Eng.*), Chêne à la galle (*Fr.*).

Hab.—Asia Minor, Syria, Turkey. The galls.

Vernacular.—Májuphal, Máphal (*Hind., Beng.*), Maiphala, Mája (*Mar.*), Máshik-káy (*Tam.*), Máshi-káya (*Tel.*), Máchi-káyi (*Can.*), Mayaphal (*Guz.*).

History, Uses, &c.—The Sanskrit name for galls is Máyin or Máyika, and signifies "magic," the gall-nut being used in India in magic rites.

Galls were well known to the Greeks and Romans, who used them medicinally on account of their astringent properties.* India has probably been supplied with them from an early date, *viâ* the Persian Gulf, the greater portion being still shipped at Basra on board Arab vessels, hence the names Basra and Maka galls. The medicinal uses to which galls are put in India hardly differ from those with which we are familiar. The Hindus divide them into two kinds, black and white, and generally prescribe both kinds together in the same prescription. Mahometan writers direct the dark-coloured unperforated galls to be selected as the best.

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* Compare with Dios., i. 127. *περὶ κηκίδων*; and Pliny, 16, 9, and 24, 5.

The Arabs call them عفص (*afs*), and say that the tree, which is not of the land of the Arabs, bears one year galls and another Ballút (acorns). In Persia they are known as Mázú or Mázún; the author of the *Burhán* says they are used by tanners, و زنان هم گاهي بجهت تنگي موضع مخصوص بکار برند

In modern medicine tannic and gallic acids obtained from galls are generally used in preference to the raw material.

The action of tannin is chiefly local, and is due to its power of coagulating albumen; it is therefore a useful application when the skin has been deprived of its epidermis by diseases such as intertrigo, impetigo and eczema, as it forms with the exudations a protective coating, and at the same time contracts the cells of the skin.

When applied to a mucous membrane, it causes dryness, coagulation of mucus, and destroys to a great extent the sensibility of the membrane; on this account it is employed in stomatitis, sore-throat, and cough due to irritation at the back of the pharynx, and also as an injection in chronic discharges from the genito-urinary passages.

When taken into the stomach in large doses it causes irritation, and possibly vomiting, but in smaller doses it is often useful in hæmatemesis and intestinal hæmorrhage by coagulating the blood and thus acting as a styptic. In poisoning by the alkaloids it acts as a chemical antidote by forming tannates which are but sparingly soluble in the juices of the alimentary canal; it is also used as an antidote in poisoning by tartar emetic, with which it forms an insoluble tannate. When used as an antidote its administration should be followed by a purgative, as the tannates of the alkaloids will be partially redissolved, if allowed to remain in the intestines.

Dr. R. Stockman has conducted a series of careful experiments with gallic and tannic acids, with the object of determining the influences which the vegetable astringents exert upon the blood-vessels and animal tissues after absorption. He finds that tannic acid on its entry into the stomach forms alkaline tannates and tannates of albumin. A part of it, and sometimes the whole, is converted into gallic acid in the stomach and intestines, and it is difficult to find a trace of tannic acid in the blood, although it can be detected in the urine. Dr. Stockman comes to the conclusion that tannic acid enters the circulation in combination with alkalies and albumin, and is excreted with such rapidity that only a trace of its presence can be detected in the blood, but that its presence in the genito-urinary tracts and in greater quantity in the intestines can be readily shown. It does not appear to be excreted by the mucous lining of the air passages. It was found that the urine of dogs, rabbits, and human beings, after the administration of tannic acid, contained gallic acid and only a small quantity of tannic acid, but when tannate of soda was administered the urine contained a large proportion of tannic acid and but little gallic acid. These results may be explained in the following manner:—When free tannic acid is brought in contact with the contents of the stomach, it is chiefly converted into tannate of albumin, only a small quantity of alkaline tannate being formed. The tannate of albumin being very insoluble is retained for a long time in the intestines, until it is in a condition to be converted into gallic acid, in which form it is at length absorbed; on the other hand, the alkaline tannate is at once absorbed and passes off in the urine. Under these circumstances, the administration of tannate of soda naturally gives rise to the presence of a large proportion of tannic acid and a small proportion of gallic acid in the urine.

Dr. Stockman did not find pyrogallic acid in the urine, but this experience is in opposition to that of other experimenters.

When gallic acid was administered, that acid only was found in the urine.

According to Dr. Stockman, tannic acid exerts no action upon the urinary excretion, and gallic acid does not cause contraction of the blood-vessels, but on the contrary dilates them even after contraction has been induced by the action of an alkaline liquid. The neutral gallate of soda, in which form gallic acid circulates in the blood, was found to have no action upon the vessels.

Catechu-tannic acid and Rhatania-tannic acid gave the same results; tannic acid being insoluble in a solution of chloride of sodium could not be experimented with in this manner. Alkaline tannates and tannates of albumin did not affect the calibre of the vessels. Fikentscher has stated that tannic acid administered hypodermically to frogs stimulates the vaso-motar centres and increases the blood pressure, but Dr. Stockman found that gallate and tannate of soda administered in this way to rabbits did not affect the pressure. Pyrogallic acid yielded similar results.

As regards the therapeutic value of gallic acid as a local application or when absorbed into the blood, Dr. Stockman considers that it has no special astringent action, but that it diminishes the alkalinity of the blood and increases its tendency to coagulate: as a local application it is useless. Tannic acid precipitates albumin and forms a protective layer of tannate, which is advantageous in certain diseased conditions which we have already noticed. In its passage through the kidneys it is very doubtful whether it exerts any therapeutic action, but Ribbert considers that it lessens the exudation of albumin in albuminuria. Tannic acid is sometimes injected into the rectum to destroy thread worms, which it does by coagulating the albumin in their delicate tissues.

Description.— Two kinds of gall are found upon Oak trees, hard and soft; the former are the galls of commerce, and are produced by a Cynips which punctures the buds of the tree and deposits its egg in the puncture; the latter result from the puncture of an aphis.

Gall-nuts are globular or pyriform bodies, studded with numerous tuberosities; those which still contain the insect are of a blackish or bluish-green colour and heavy; those from which the insect has escaped are of much lighter colour, generally yellowish-white, on one side a round hole may be perceived; they are also lighter in weight and less astringent. When a gall is cut in two a round cavity is seen in its centre, which may or may not be occupied by the insect; in the latter case a passage leads from the cavity to the exterior.

Microscopic structure.—The contents of the central cavity, if present, are seen to consist of a starchy parenchyme destined to supply food to the larva. The walls of the cavity are formed of stone-cells. The bulk of the gall consists of cells arranged in a radiating manner, many of them containing colouring matter and tannin. Towards the exterior of the gall the cells contain dark-coloured chlorophyl; on the very surface the cells are small and thick-walled and form a kind of rind.

Chemical composition.—The principal constituent of galls is tannin or tannic acid. The tannin of different plants possesses distinctive characters; that obtained from galls is known as gallo-tannic acid. It is identical with the tannin of *Rhus coriaria*, Linn. (Sumach).

Galls afford from 60 to 70 per cent. of tannin, and about 2 per cent. each of gallic and ellagic acids.

Commerce.—Galls are imported from Basra and the Persian Gulf ports. Value: White, Rs. 10 per maund of 37½ lbs.; Blue, Rs. 17. Imports about 1,400 cwts. yearly.

SALICINEÆ.

SALIX CAPREA, *Linn.*

Fig.—*Eng. Bot.*, 1488; *Reichb. Fl. Germ.*, *t.* 577. Great round-leaved Sallow, Goats' Sallow (*Eng.*), Marceau, Marsault (*Fr.*).

Hab.—Persia, Europe. Cultivated in N.-W. India. The bark, leaves, seeds, and flowers.

Vernacular.—Bédmishk (Indian Bazars).

History, Uses, &c.—The willow *ἰτέα* was well-known to the ancient Greeks, and the Greek name is considered to be cognate to the Sanskrit Vitika, the old German Wida, and the old English With or Withy. Herodotus (i.,194) mentions it, and Theophrastus (H. P. iii., 13) mentions two kinds, *λευκὴ* and *μέλαινα*. Dioscorides (i.,121) notices its astringent properties, and the various medicinal uses to which the bark, leaves, seed and juice were put. Pliny (17, 20) describes the cultivation of the willow, and (24, 9) its medicinal properties. The ancients considered it to be very cooling, "Porro impediunt et remittunt coitum folia salicis trita et epota"; it was also thought to occasion sterility in women. The concrete juice of the plant mentioned by Greek and Latin writers is considered by Fée to have been a kind of manna.

Ibn Sina, under the name of Khiláf, follows Dioscorides closely in his description of the medicinal uses of the willow, but he mentions the use of the flowers of *S. Caprea* separately under the name of Behramaj, a corruption of the Persian Behrameh. The Mahometan physicians all mention the juice or gum (صمغ) of the plant, and Haji Zein states that it exudes from the leaves. It is probably the substance described by M. Raby (*Union Pharm.*, May, 1889), under the name of *Bidenguébine* or "willow honey," said to be derived from the leaves and young branches of a willow, and to have a feebly saccharine taste.

In Persia *S. Caprea* is known as Bid-i-Balkhi, and its flowers as Bidmishk; willow bark is still a popular febrifuge in that country. Aitchison mentions the following species of Salix as occurring wild or cultivated in Persia:—*S. pycnostachya*, Anders., *S. acmophylla*, Boiss., *S. babylonica*, Linn., *S. Daviesii*, Boiss., *S. alba*, Linn., *S. songarica*, Anders., and *S. Caprea*, Linn.

In China and Persia the tree is considered to be symbolic of immortality. *S. babylonica* is planted in burial grounds in the latter country, and has been introduced into India by the Moghals for this purpose; among the Romans it was sacred to

Juno Fluonia. For an account of the funereal use of the willow in China, the reader is referred to Schlegel's *Uranographie Chinoise*, or De Gubernatis' *Myth. des Plantes*, article *Saule*.

The Persian settlers in India have introduced the flowers (*bidmishk*) and the distilled water (*ma-el-khilāf*) of *S. Caprea*, both of which are used by the upper classes of Mahometans and Parsees, who consider them to be cephalic and cardiacal, and use them as domestic remedies in almost every kind of slight ailment.

Raughan-i-bid, an oil prepared by boiling two parts of the distilled water with one of sesamum oil until the water has all evaporated, is a favorite remedy for cough.

For a long series of years the willow fell into disuse in Europe, but was again brought into notice in 1763 by the Rev. Mr. Stone, who published a paper on the efficacy of the bark of *S. alba* as a remedy for agues. The broad-leaved willow bark (*S. Caprea*) was subsequently introduced into practice by Mr. James, whose observations on its efficacy were afterwards confirmed by Mr. White and Mr. G. Wilkinson (*Pereira, Mat. Med.*, ii., Pt. 1, p. 337). Willow bark was formerly official in the London, Edinburgh, and Dublin Pharmacopœias, and was considered no bad substitute for cinchona in agues. *S. Caprea* is one of those willows which yield *salicin* and tannin, and is remarkable for its large yellow fragrant catkins.

Salicin, which was discovered in 1825, and first obtained in a pure state in 1830, was at first much vaunted as an antiphlogistic by Riess and others in those cases in which salicylic acid is now employed; it was also used as an antiperiodic in ague, and is said to have been found efficient in preventing the development of acute coryza and influenza, and in mitigating the symptoms of hay fever. It was usually administered in 10-grain doses frequently repeated. More extended experience, however, led to the conclusion that it has little or no influence temperature, and the drug gradually fell into disrepute iscovery of the antiphlogistic properties of salicylic acid, when it was again experimented with by Ringer and Bury, who showed that it had no influence upon the temperature of healthy children. They observed that under full medicinal doses a dusky flush suffuses the face on slight excitement, while the expression becomes dull and heavy. Less constant symptoms are deafness, noises in the ears, frontal headache, trembling of the hands and quickened breathing. Very large doses occasion severe headache, marked muscular weakness, tremor and irritability, with a rapid and feeble pulse.

Description.—Catkins 1—2 inches long, thick, cylindrical, bright yellow, fragrant; bracts oblong, small; scales obovate, blackish, hairy; nectary ovate, papillary; stamens longer than the scales, with oblong yellow anthers; germ ovate-lanceolate, silky, on a hairy stalk; style hardly any; stigma oblong, thick, undivided. Bark purplish-brown externally, minutely downy when young, internally white; tough and fibrous.

Chemical composition.—Willow bark has been shown to contain *salicin*, wax, fat, gum, and a tannin which gives with ferric salts a blue-black precipitate, the liquid becoming purplish-red on the addition of soda. Johanson (1875) has also shown the presence of a kind of sugar having a slightly sweet taste and reducing alkaline copper solution with difficulty, and of the glucoside benzohelicin, $C^{20}H^{20}O^{8}$. Salicin, a glucoside, crystallizes in colourless plates or flat rhombic prisms, but it usually occurs in commerce in white glossy scales or needles. It remains unaltered in the air, is neutral to test-paper, inodorous, and has a persistently bitter taste. It is soluble in about 30 parts of water at 11·5° C., and is somewhat less soluble in alcohol. It dissolves in 0·7 part of boiling water and in 2 parts of boiling alcohol. (*United States Pharm*) Cold sulphuric acid dissolves salicin with a bright red colour; after the absorption of water from the air (but not after the addition of water or after being neutralized by an alkali), the solution deposits a red powder (*rutilin*), which after washing is yellowish-red, after drying blackish-brown, insoluble in water, alcohol, and glacial acetic acid, and is coloured violet-red by alkalies. (*Braconnot.*) On warming salicin with somewhat diluted sulphuric acid and potassium bichromate, *salicylous acid* or *salicyl-aldehyd,* $C^7H^6O^2$, is given off, recognizable by its peculiar fragrance, resembling that of meadow-sweet (*Spiræa ulmaria*).

Salicin when digested with emulsin or saliva, or heated to 80°C. with dilute sulphuric acid, assimilates 1 molecule of water, and is split into glucose and *salicylic alcohol* or *saligenin,* $C^7H^8O^2$, which crystallizes in pearly tables, is easily soluble in hot water, alcohol, and ether, melts at 82°C., and sublimes at 100°C. Saligenin is characterized by yielding in solution a deep-blue colour with ferric chloride, and when boiled with dilute acids by being converted into a resinous body, *saliretin,* $C^{14}H^{14}O^3$, while oxidizing agents convert it into salicylous and salicylic acids. Cold nitric acid, sp. gr. 1·16, oxidizes salicin, with the production of *helicin,* $C^{13}H^{16}O^7$, which crystallizes in white needles, and is by ferments and dilute acids resolved into sugar and salicylic aldehyd. If nitric acid of sp. gr. 1·09 is employed, salicin yields *helicoidin,* $C^{26}H^{34}O^{14}$, which may be regarded as a compound of salicin and helicin. (*National Dispensatory.*) For a full account of these interesting reactions, the reader is referred to *Watts' Dict. of Chemistry,* Vol. V., p. 147.

Bidangubin or "willow honey" has been examined by Raby (*Union Pharm.*, May, 1889, p. 201). It affords about 12 per cent. of sugar, estimated as glucose, and a considerable quantity of a sugar crystallizing in opaque hard crystals like those of sugar of milk. It melts at 150° to a transparent liquid, and dissolves in 5·5 parts of water at 15° C. The formula is given as $C^{12}H^{22}O^{11}$. This sugar evidently possesses considerable affinity to melezitose, from which it differs, according to M. Raby, in not being efflorescent, and in the greater rotatory power of the glucose derived from it by inversion over that obtained from melezitose. The inversion by means of dilute hydrochloric acid also takes place more rapidly. He therefore proposes to call the new sugar *bidenguébinose.*

GNETACEÆ.

EPHEDRA VULGARIS, *Rich.*

Fig.—*Reichb. Ic. Fl. Germ., t.* 539; *Bertolon. Miscell. xxiii., t.* 3.

Hab.—Temperate and Alpine Himalaya, Europe, W. and Central Asia, Japan.

EPHEDRA PACHYCLADA, *Boiss.*

Hab.—Western Himalaya, Afghanistan, E. Persia.

Vernacular.—*E. vulgaris*—Amsánia, Butshur, Cheva (*Punj.*), Khanda, Khama (*Kunawar*), Phok (*Sutlej*), Ma-oh (*Japan*). *E. pachyclada*—Hum, Huma (*Pers., Bomb.*).

History, Uses, &c.—These two species are hardly different; *E. pachyclada* is rather more robust than *E. vulgaris* and more scabrid. Of the former, Sir J. D. Hooker remarks:—"I can find no good characters in the spikes and flowers, except the more or less margined bracts." A specimen of the Persian plant kindly furnished to one of us by Mr. K. R. Cama of Bombay, was identified at Kew as *E. vulgaris*. Dried branches of the Huma are still brought from Persia to India for use in Parsi ceremonial,and it is considered to have medicinal properties. The plant was used by the ancient Arians, and is probably the same as the Soma of the Vedas. Aitchison (*Proc. Linn. Soc.*, x., 77) notices the medicinal use of *E. vulgaris* in Lahoul, and he and Griffith state that the ashes of *E. pachyclada* are used as a snuff and dye in Afghanistan. Dr. N. Nagai of Tokio, Japan (*Berl. Klin. Wochenschr.*, 1887, 706), first drew attention to the fact that *E. vulgaris* contains an alkaloid (*ephedrine*) which possesses the property of dilating the pupil of the eye, and which may be used in the place of atropine. T. V. Biektine (*Bolnitch. Gaz. Botkina*, 1891, No. 19, pp. 473—476) has brought to notice the use of a decoction of the stems and roots of *E. vulgaris* as a popular remedy for rheumatism and syphilis in Russia, and of the juice of the berries in affections of the respiratory passages. After administering the decoction himself in a number of cases of rheumatism, acute and chronic, he comes to the conclusion that the plant is especially valuable in acute muscular and articular forms of the disease: the pain is relieved, the pulse becomes less rapid and softer, and the respiration easier. Within 5 or 6 days the temperature becomes normal, the swelling of the joints disappears, and after about 12 days' treatment the patient is cured. In several cases marked diuresis was observed before or about the time that the temperature began to decrease; the drug was also observed to improve the digestion and promote the action of the bowels. In chronic cases the action of Ephedra was less marked, and in two cases of rheumatic sciatica and osteo-myelitis hardly any effect was produced, but it is only fair to remark that antipyrine, salicylate of soda, antifebrine, salol, &c., also failed to afford relief in these two cases. The decoction used by Dr. Biektine was made with 3·85 grams of the drug to 180 grams of water. Kobert has shown that 0·20 gram of ephedrine injected into the veins of dogs and cats produces violent excitement, general convulsions, exopthalmia and mydriasis. (*Nouveaux Remèdes*, Aug. 8th, 1891.)

Description.—*E. vulgaris* is a low-growing, rigid, tufted shrub, with usually a gnarled stem and erect green branches which are striate and nearly smooth. Bracts connate to the middle, not margined, eciliate, rarely produced into minute linear leaves. Spikelets ¼ to ⅓ inch, subsessile, often whorled; fruiting with often fleshy, red, succulent bracts, 1 to 2 seeded. Seeds bi-convex or plano-convex.

E. pachyclada has the same characters, but is usually more scabrid. Sir J. D. Hooker remarks:—"I have many specimens from N.-W. India that I do not know whether to refer to *vulgaris* or *pachyclada.*" The twigs of these plants have a terebinthinate and astringent taste, and sections when magnified show the tissues to be loaded with an inspissated red juice.

Chemical composition.—Dr. N. Nagai (*Tokio Chem. Society*, through *Chem. Zeit.*, 1890, p. 441) obtained the alkaloid *Ephedrine* from the stem of *Ephedra vulgaris* (Ma-oh). Its composition is $C^{10}H^{15}NO$; by oxidation the alkaloid is split into benzoic acid, monomethylamine and oxalic acid. *Isoephedrine*, melting point 114°C., is obtained by heating ephedrine, melting point 30°C., with hydrochloric acid in a closed tube to 180°C. The constitution of ephedrine is $C^6H^5CH^2$ CH $(NHCH^3)$ CH^2OH, and that of isoephedrine is $C^6H^5CH^2C$ (OH) (NH CH^3) CH^3.

The hydrochlorate of ephedrine forms acicular crystals which are freely soluble in water. Mr. J. G. Prebble (1889) found the twigs of *E. vulgaris* to contain 3 per cent. of a tannin, giving a whitish precipitate with gelatine and acetate of lead, and a greenish precipitate with acetate of iron.

CONIFERÆ.

JUNIPERUS COMMUNIS, *Linn.*

Fig.—*Richard. Conif.* 33, *t.* 5; *Reichb. Ic. Fl. Germ.*, *t.* 535. Juniper (*Eng.*), Genévrier (*Fr.*).

Hab.—Western Himalaya, Persia. The fruit.

Vernacular.—Hab-el-a'ra'r (*Ind. Bazars*).

History, Uses, &c.—A'ra'r (عرعر) is a Persian word; the author of the *Burhán* notices a popular belief that the Juniper is the enemy of the Date tree, and that the two will not grow together in the same place. Abu Hanifeh states on the authority of an Arab of the people of the Saráh, who are possessors of the *a'ra'r*, that it is the same as the Abhal (the latter name is applied in modern Arabic to the Juniper and Savine). He adds that he knew it in his own country, and afterwards saw it in the province of Kazween, cut for firewood from the mountains, in the neighbourhood of Ed-Deylem, and that the fruit is eaten when ripe. *J. communis* is a native of Greece, and must therefore have been known to the ancient Greeks, but there is much difficulty in identifying the two species of 'αγκευθίς mentioned by Dioscorides. The fruit of some species of Juniper was, however, used by Hippocrates in certain disorders of the womb, and Dioscorides mentions its diuretic properties, its use in cough and pectoral affections, and also its digestive properties. The ashes of the bark were also applied locally in certain skin affections.

Ibn Sina closely follows Dioscorides and gives no additional information concerning the plant. The several kinds of Juniper growing on the Himalayas do not appear to be used medicinally by the Hindus, and the berries sold in the bazaars by Mahometan druggists are all imported from the west *viâ* Bombay.

In modern medicine Juniper is only used as a diuretic.

Description.—Juniper-berries are nearly globular, about ⅓ inch in diameter, dark-purplish, and covered with a bluish-gray bloom; the short stalk at the base contains one or two whorls of the small scales, and the apex is marked by three radiating furrows, which are surrounded by ridges enclosing a triangular space. The three, or by abortion one or two, bony seeds are ovate in shape, triangular above, have six to ten large oil-sacs on their surface, and are imbedded in a brownish pulp which likewise contains oil-cells. The berries have an aromatic somewhat balsamic odour, and a sweet, terebinthinate, bitterish, and slightly acrid taste.

Chemical composition.—Juniper-berries were analysed by Trommsdorff (1822), Nicolet (1831), Steer (1856), and Donath (1873). They contain from ½ to 2½ per cent. of volatile oil, about ·30 per cent. of sugar, resins amounting to 10 per cent., 4 of protein compounds, fat, wax, formic and acetic acids, malates, and *juniperin,* which is light-yellow, slightly soluble in water, freely so in alcohol and ether, and with a golden-yellow colour in ammonia. Ritthausen (1877) obtained from juniper-berries, containing 10·77 per cent. of water, only 14·36 per cent. of sugar, 3·77 of ash, and 31·60 of cellulose.

Oil of juniper-berries is colourless or pale greenish-yellow, limpid, but on exposure rapidly thickens and turns yellow, and ultimately reddish-brown, at the same time acquiring an acid reaction; the fresh-distilled oil from old juniper-berries is thickish and light-yellow. Its specific gravity is about ·870, but varies between ·85 and ·90; it begins to boil at 155° C., or, if obtained from ripe berries, at 205° C. (Blanchet), has the peculiar odour of the berries and a warm, aromatic, somewhat sweetish and terebinthinate taste, shows a neutral reaction to test-paper, turns polarized light slightly to the left, and is slightly soluble in alcohol, forming with 10 or 12 parts of 80 per cent. alcohol or with 2 or 3 parts of officinal alcohol a more or less turbid solution; but it yields clear mixtures with carbon disulphide in all proportions. Iodine dissolves slowly in the limpid oil, but acts more energetically upon the thickened oil, sometimes producing fulmination; sulphuric acid colours it brown and red. Old oil of juniper contains formic acid, from which it may be freed by sodium carbonate and rectification.

The oil is a mixture of hydrocarbons of the general formula $C^{10} H^{16}$, which differ in their boiling-point, a portion boiling at 282°C. It yields with hydrochloric acid gas a liquid compound. (*Stillé and Maisch.*)

TAXUS BACCATA, *Linn.*

Fig.—*Wall. Tent. Fl. Nep., t.* 57; *Griff. Ic. Pl. Asiat.*, 376; *Bentl. and Trim., t.* 253. Yew (*Eng.*), If (*Fr.*).

Hab.—Temperate Himalaya. The leaves.

Vernacular.—Tálispatar (*Ind. Bazars*).

History, Uses, &c.—Under the name of Tálisa-pattra or Talipattra, Sanskrit medical writers describe a drug which has carminative, expectorant, stomachic, tonic and astringent properties, and is useful in phthisis, asthma, bronchitis, and vesical catarrh; the powdered leaves are given with the juice of *Adhatoaa Vasica* (vasaka) and honey in cough, asthma, and hæmoptysis. A confection called *Talisadya churna* is prepared with Talispattra, black pepper, long pepper, ginger, bamboo-manna, cardamoms, cinnamon, and sugar, and is used in the abovementioned diseases. The author of the *Burhán*, the oldest Persian Dictionary, which contains a large collection of Pahlavi words, mentions the same drug under the name of Tálisfar, and states that this name was applied by the Greeks to the leaf of the Indian Olive, or, according to some, to its root-bark. Ibn Sina speaks of it as an Indian bark, and describes its properties in the same manner as the Sanskrit writers; he states that Galen considers it to be possessed of hot and cold properties in equal proportion, but that others say it is hot and dry. Yahia bin Isa, the author of the *Minháj*, considers Talisfar to be the leaf of the Indian Olive; Ibn Baitar thinks that it is Mace. Haji Zein-el-attár identifies it with the μακερ of the Greeks, and says it is the root-bark of the Indian Olive, a bark thicker than China cinnamon and harder and of a darker colour, very astringent and slightly aromatic. The author of the *Makhzan-el-Adwiya* mentions the drug in two places, and identifies it incorrectly with the *Zarnab* of the Arabs; he also appears to confound it with *Hydrocotyle asiatica*. Speaking of Zarnab, he says, "it is also called *Rijl-el-jarád* (locust's foot). In Hindí it is *brahmi*, *barambhi* and *sapni*, and one kind of it is called *Manduparni* and *barahmi*, and the plant is called *Tális*, and the leaves, which are the same as Zarnab, are called *Tálispatr*. It is a plant with leaves broader than those of *Sátar-i-bari*, of a yellowish colour, and scented like a citron; the flower is yellow, and the plant is less than a cubit in height, with a quadrangular hollow stem; it has a pungent taste, and retains its properties four years. It grows in the hills of Fars, and is called *Sarv-i-Turkistáni;* it is also found in Hindustan and Bengal. * * * * It is hot and dry in the second degree, and has stimulant, astringent, stomachic, pectoral and digestive properties similar to cinnamon; the fresh juice is intoxicating; mixed with oil of roses or violets and introduced into the ear it cures cold headache. Substitutes, double the quantity of cinnamon, cubebs, cassia, or cardamoms.* * * *" Again, speaking of *Tálisfar*,[*] an article described as one concerning the identity of which there is much difference of opinion, the author of the *Makhzan* says, "perhaps it is the same as Zarnab, which is called Tális in Hindí, and which is the *narrow leaf of a tree of a dusty colour, externally and internally yellow.*" If we turn to the older Arabian writers, we find that we have no reason to identify Zarnab with Tálisapattra; they say that it is a certain perfume or certain sweet-smelling tree (*Kámús*), or a species of sweet-smelling plant (*Sihah*); it consists of slender round twigs, between the thickness of large needles and of writing reeds, black inclining to yellowness, not having much taste or odour, what odour it has, being of a fragrant kind like citron. (*Ibn Sína*, Book II.) According to the Turkish Kámús, it is the leaf of a sweet-smelling plant called رجل لجراد (locust's foot). Sprengel thought it was *Salix Ægyptiaca.* (Confer. *Hist. rei. herb.*, T. II., p. 270.) Zarnab is of the measure فعلل and is a genuine Arabic word. A rájiz says—

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[*] Under this name Royle obtained the leaves of Rhododendron lepidotum, which are highly aromatic. (*Antiq. of Hind. Med.*, p. 91.)

یا بابی انت وفوک الاشنب کانما ذر عایده الزرنب

"O with my father thou *shouldst be ransomed*, and thy mouth, that is cool and sweet, as though Zarnab were sprinkled upon it." (*Sihah.*)

In the tradition of Umm Zara, where it is said المس مس ارنب والریح ریح زرنب "the feel is the feel of a hare, and the odour is the odour of Zarnab," Ibn el Athír, author of the *Nihayeh*, says that it signifies saffron (*Madd-el-kamús*). Ainslie (ii., 407) considers Tálispatar to be the leaves and twigs of *Flacourtia cataphracta*, Roxb. Dr. U. C. Dutt, in his Hindu Materia Medica, states that the Tálispatar of the Calcutta shops consists of the leaves and twigs of *Abies Webbiana*, Lindl.* Dr. Moidín Sheriff gives the name of Tálishapatri to the leaves of *Cinnamomum Tamala*, Nees. It would appear, therefore, that it is uncertain at the present time what the Tálisapattra of Sanskrit writers is, and that in different parts of the country various drugs are used as substitutes for it.

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* Webb's or purple-coned fir.

All the samples of the drug which we have obtained from Bengal, Northern, Western and Southern India have consisted of the leafy twigs of the yew chopped in lengths of from one to two inches.

The yew was known to the Greeks and Romans as a poisonous plant.* Modern enquiry has shown that the leaves and seeds are poisonous, but not the red pulp surrounding the latter. The leaves have, however, been recommended in doses of from 1 to 5 grains in epilepsy and other spasmodic affections. As an abortive they have been often administered, and have generally proved fatal to the woman, without causing the expulsion of the fœtus. Moderate doses given to animals occasion hurried breathing and palpitation of the heart, followed by recovery, and larger doses produce a similar effect followed by death from syncope. Very large doses appear to produce death by syncope without pain or spasm. According to Borcher's (1876) experiments, taxine reduces the pulse and respirations and causes convulsions, with fatal asphyxia. (Husemann.) After death the evidences of gastro-intestinal inflammation have generally been slight, the heart was usually empty, the kidneys strongly congested, and the blood less coagulated than usual. The effects produced upon man by poisonous doses of yew resemble those above mentioned as occurring in animals: after large doses the nervous irritation, exhaustion and gastric disturbance may be very trifling, the patient dying by syncope.

Description.—The drug consists of the small branches of the tree with their linear-lanceolate, narrow, rigid veinless leaves cut up into short length (1 to 2 inches). The male flowers are to be found upon some of the sprigs, and resemble those of the common yew. The wood of the larger stems is that of a yew, and not of a pine.

Chemical composition.—Statements have been made at different times as to the presence in the leaves and fruit of the yew (*Taxus baccata*) of an alkaloidal principle. In 1876 (*Pharm.*

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* *ταξος* and *σμιλαξ*. Dios. 4, 80 ; Plin. 16, 20.

Journ., [3], vii., 894), Marmé described a crystalline alkaloid that he had separated from the leaves and fruit, which he named "*taxine,*" and spoke of as being poisonous. It was obtained by treating an ethereal extract of the leaves and fruit with water acidulated with sulphuric acid and precipitating this solution with ammonia. Messrs. Hilger and Brande report (*Berichte*, xxiii., 464) that, working on the leaves in the same way, they have separated an alkaloid, which they failed to crystallize. This taxine melted at 82° C., and when heated in a glass tube gave off white fumes that condensed on the colder parts of the tube to oil-like drops that solidified on cooling, at the same time a characteristic aromatic odour was evolved. It dissolved in water in traces only, freely in alcohol and ether, with more difficulty in chloroform, and was insoluble in benzol. It was coloured intense purple-red by concentrated sulphuric acid and intense red-violet by Fröhde's reagent, and gave yellowish precipitates with the ordinary alkaloidal reagents, and white precipitates, insoluble in excess, with the fixed alkalies and ammonia. The salts of taxine are mostly readily soluble in water, but only the hydrochloride was obtained well crystallized, and this by passing a current of hydrochloric acid gas into a solution of the alkaloid in anhydrous ether. Analysis of taxine gave results corresponding with the formula $C^{37}H^{52}O^{10}N$, and its behaviour with ethyl iodide indicated that it is a nitrile base. The authors do not seem to have occupied themselves with the physiological action of taxine. (*Pharm. Journ.*, Mar. 29, 1890.)

Toxicology.—No cases of poisoning by this plant have been recorded in India, but considering its common use as a drug throughout the country, we cannot help suspecting that such accidents must have happened, especially as the native doctors do not appear to be aware of its poisonous properties. Several cases of poisoning by yew have occurred in England, most of which have ended fatally. The prominent symptoms were vomiting followed by narcotism, with, in some cases, convulsions and dilated pupils, respiration slowed; death usually by asphyxia, due to paralysis of the respiratory muscles.

PINUS LONGIFOLIA, *Roxb.*

Fig.—*Royle Ill., t.* 85, *f.* 1; *Griff. Ic. Pl. Asiat., tt.* 369, 370.

Hab.—Outer Himalayan Ranges. The turpentine.

Vernacular.—Saral, Chir (*Hind.*). The turpentine, Ganda-biroja (*Ind. Bazars*).

History, Uses, &c.—The wood, in Sanskrit Sarala, and the turpentine Sarala-drava, are mentioned as medicinal in Sanskrit works; plasters, ointments, and pastiles for fumigations are directed to be made from the turpentine. The latter, under the name of Ganda-biroja, or, more correctly, Gandah-birozah, is found in all the Indian bazars, and appears to have all the properties of ordinary turpentine, though differing from it in odour. It is chiefly used as a pectoral plaster like the pitch plaster of Europe, but it has also a reputation in veterinary practice as a remedy for mange. The *Vaids* obtain from it by distillation without water a limpid sherry-coloured oil having the peculiar odour of the drug, which they call *Khanno oil* in the Deccan; it is in much repute as a remedy for gleet or long-standing gonorrhœa.

Collection.—The Chir Pine, which is a large tree of Afghanistan and the North-West Himalayas, is the chief source of this turpentine. Atkinson, who describes its collection in Gurhwal and Kumaon, says that it is there called *Birja* and *Lisha* or *Lassa,** and that there are two kinds collected, *viz.*, the *natural exudation* and *Bakhar-birja,*† which is obtained by making incisions in the sap-wood. The yield of a tree thus treated is said to be from 10 to 20 lbs. the first year, and about one-third the quantity the second year, after which the tree either dies or is blown down. (*Atkinson, Brandis.*)

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* लासा lásá; Illit. lásha; any viscous exudation of plants.

† बाखल, बाखर, or बखर an enclosure, house, chamber. An allusion to the small chamber cut in the tree to receive the turpentine.

Description.—Gandah-birozah is a dirty-white opaque substance, of soft and sticky consistence, having a strong and peculiar odour, more aromatic than that of common turpentine; the leaves of some tree, which have evidently been used in collecting the turpentine, are usually found mixed with it in considerable quantity.

Chemical composition.—56 lbs. of the crude drug distilled with water yielded 8 lbs. of a colourless limpid oil, having the peculiar odour of Gandah-birozah. The resin remaining in the still was of a dull brown colour; after straining to remove impurities it was stirred with a small quantity of boiling water until hard, and afforded a very fair substitute for Burgundy Pitch, weighing 43 lbs.

The oil, according to Lyon, has a specific gravity of ·875 at 82° F.; it commences to boil at about 310° F., and is dextrorotatory.

Pinus Khasyana, the Khasya Pine of Assam, yields a fine quality of turpentine. A full-grown tree gives as much as 68 lbs. of crude resin a year. The oil is very pure, and Dr. Armstrong in 1881, reported that it had the greatest amount of action on polarized light of any coniferous oil of turpentine he had examined.

Pinus Gerardiana, *Wall. Lamb. Pin. Ed.* 3, *t.* 79; *Royle Ill.* 353, *t.* 85, *f.* 2; *Cleghorn Pines of N.-W. Himal.*, *t.* 4, a native of Afghanistan and Persia, yields the pine-nuts which are sold in the Indian bazars under the name of *Chilghozeh*, and are described in Mohometan medical works under the Arabic name of *Hab-el-sanaubar-el-kibár*. In Persia the tree is called *Sús* (سوس) and in Afghanistan *Chil* and *Zan-ghozeh*. Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia*, p. 152) states that the seeds are one of the great trade products exported from the district of Kost and the Kuram Valley to India; they have stimulating properties, and are considered useful in chronic rheumatic affections, and as an aphrodisiac. They are usually administered pounded with honey, in the form of a confection; they are of a brown colour, about one inch in length, and have an oleaginous and terebinthinate flavour.

Church, "Food Grains of India," found the percentage composition of the seeds to be Water 8·7, Albuminoids 13·6, Starch 22·5, Oil 51·3, Fibre 0·9, and Ash 3·0.

CEDRUS LIBANI, *Barrel.* var. *Deodara.*

Fig.—*Hook. f. Nat. Hist. Rev. ii., t.* 1-3; *Forbes, Pinet. Wob., t.* 48, 49; *Griff. Ic. Pl. Asiat., t.* 364.

Hab.—N.-W. Himalaya. The wood.

Vernacular.—Deodár-ki-lakri (*Ind. Bazars*).

History, Uses, &c.—This tree, in Sanskrit Devadáru, Suradáru, Suradruma "tree of the gods," yields the Bhadrakashtha "auspicious wood," Sneha-viddha "impregnated with oil," which is used as a carminative, diaphoretic, and diuretic by the Hindu physicians in fever, flatulence, inflammation, dropsy, urinary diseases, &c. It is chiefly used in combination with other medicines, as in the following diuretic mixture:—Take of Devadáru wood, root of *Moringa pterygosperma* (Sigru), and *Achyrantes aspera* (Apámárga), one drachm each and reduce to a paste with cow's urine. To be given in ascites. (Chakradatta.) The wood is also ground to a paste with water and applied to the temples to relieve headache. A tar (*Kilan-ka-tel*) made by destructive distillation of the wood is a favourite remedy for skin diseases in Northern India; it is given internally in doses of about one drachm, and also applied locally. From the Sanskrit name Devadáru of this wood, it must not be confounded with the wood of *Erythroxylon monogynum*, known in Tamil as Devadārum, and which, on account of its odour, is called "Bastard Sandal." *C. Libani* is the Deodár of Ibn Sina, who states that it is called *Sanúbar-el-hindi*, and is useful in rheumatism, piles, palsy, epilepsy, gravel in the kidneys or bladder and *prolapsus ani.* Háji Zein-el-Attár states that its juice is used in

Harrán (Afghanistan) to tan leather (he doubtless alludes to the tar which is used in the Punjab to dress the inflated skins used for crossing rivers).

Description.—The wood sold in the bazars is of a light yellowish-brown colour, very heavy, and in thin sections translucent, owing to the large proportion of turpentine contained in it. It has an agreeable terebinthinate odour.

Preparation of the tar.—First, an earthen vessel (*ghara*), with a wide mouth, and capable of containing about 4 seers, is sunk in the ground. Next, a large *ghara* of about 12 seers' capacity is taken, and three small holes are drilled in its underside; it is then filled with scraps of the wood, and over its mouth another smaller jar is placed, and kept there by a luting of clay; and then both the jars are smeared over with a coating of clay. These two jars thus stuck together are next set on the mouth of the receiver sunk into the ground, and the joint is made tight by clay. Firewood is now heaped round the apparatus and lighted, and kept burning from four to eight hours. The jars are then separated and the tar removed. One seer (2 pounds) of wood yields about 2·6 chittaks (5½ ounces) of tar. (*Baden-Powell, Punjab Prod.*)

Chemical composition.—An alcoholic extract of the wood was spontaneously evaporated to dryness by exposure to air, and the extract agitated with petroleum ether, and the insoluble residue treated with caustic soda and agitated with ether.

The petroleum ether extract on spontaneous evaporation left a transparent, pale yellow varnish-like residue, with a very fragrant terebinthinate odour, which became hard on exposure in thin layers, but preserved a perfect transparency. This extract was treated with aqueous caustic potash and agitated with ether. The mixture after standing separated into three layers. The lowest stratum was of a reddish yellow colour, the middle darker in colour, and the small amount which floated above the ether of a bright light yellow tint. The ethereal layer on spontaneous evaporation, left a satiny mass of fragrant odour, which, on microscopic examination, consisted of interlaced needles and narrow plates. On ignition an alkaline ash was left. In sulphuric acid it dissolved with a yellow colour, no change being induced by the addition of nitric acid to the solution or hydrochloric acid and phenol. In order to obtain this resin acid in a free state, an ethereal solution of the potash salt was agitated with dilute sulphuric acid. On spontaneous evaporation of the ether, the acid was left as a transparent varnish.

The middle layer mentioned above appeared to consist of a concentrated solution of the potash salt of the resin acid; the potash salt not being very readily soluble in ether. The aqueous stratum was treated with sulphuric acid and agitated with ether, the ethereal extract was yellow, and had a slight odour not unlike that of valeric acid.

That portion of the original alcoholic extract insoluble in petroleum ether, was now agitated with ether and aqueous potash. The ether left on spontaneous evaporation a transparent yellow extract, insoluble in water; soluble in alcohol with neutral reaction, and possessing a marked bitter taste. Sulphuric acid coloured the extract a bistre-red. The potash solution was mixed with sulphuric acid and agitated with ether; during agitation dark reddish flocks separated, which were insoluble in ether even after prolonged agitation. The ethereal solution left a yellow transparent residue. In alcohol the extract was soluble with bitter taste and acid reaction. In concentrated sulphuric acid it dissolved with a dark-red colour, the addition of concentrated hydrochloric acid afforded a colour of crushed strawberries, which became of a reddish violet on the addition of phenol. In aqueous potash the extract dissolved with a bright yellow coloration. Ferric chloride added to an alcoholic solution gave a dirty brown coloration. The flocks insoluble in ether were of a reddish-brown colour, brittle when dry, without bitterness in an alcoholic solution, acid in reaction, and affording similar reactions with sulphuric and hydrochloric acids and phenol, and ferric chloride and caustic potash, to the resin soluble in ether.

CYCADACEÆ.

CYCAS CIRCINALIS, *Linn.*

Fig.—*Richard, Conif., t.* 24—26; *Bot. Mag., t.* 2826 and 2827; *Rheede, Hort. Mal. iii.,* 9, *t.* 13—21.

Hab.—Malabar Coast, Dry Hills in W. Madras. Male bracts and flour.

Vernacular.—Jungli-madan-mast-ka-phul (*Hind.*), Madana-kama-pu, Kamappu, Chanang kay (*Tam.*), Rinbadam, Toddapana Eentha kay (*Mal.*), Malabári-supari (*Mar.*).

History, Uses, &c.—The male bracts of this tree are used in Southern India as a narcotic, and are considered to be similar in medicinal action to the flowers of *Stereospermum suaveolens*. Both drugs are termed Madana-kama-pu or flowers of Kama, and are said to contain a property that intoxicates insects that rest upon them. The bracts are powdered up with other substances and made into a confection as an aphrodisiac. Flour is made from this tree both from the stem and the nuts. In Malabar the nuts are collected and dried for a month in the sun, beaten in a mortar, and the kernels form a flour which is called *Indum Podi.* It is reckoned superior to the flour of Caryota, but inferior to rice, and is only eaten by the hill-tribes, and by the poorer classes, who, from July to September, when rice is scarce, are in danger of perishing. It has often been confounded with true sago. Rheede states that the fruit bearing cone reduced to a poultice and applied to the loins removes nephritic pains.

Description.—The bracts as sold in the bazar are of the shape of a spear head, two inches long by half an inch broad, clothed at the back with much fulvous down. A subulate incurved point rises from the exterior upper angle of each of the scales. When the strobile first appears, they are closely pressed together like the germs in the pineapple, but as it lengthens by age, they become detached from each other. Filaments none; the anthers entirely covering the under surface of the scales, one-celled, two-valved, opening round the apex on discharging the pollen. The starch of the pith resembles that of sago under the microscope.

Chemical composition.—The bracts or scales contain, in a dried state, much albuminous and mucilaginous matter soluble in water, but no alkaloid or other principle that would account for its reputed narcotic action.

ORCHIDEÆ.

ORCHIS LATIFOLIA, *Linn.*

Fig.—*Fl. Br.* 924; *Engl. Bot.* 33., *t.* 2308; *Reichb. Fl. Germ. xiii.*, *t.* 50. Marsh Palmate Orchis (*Eng.*).

Hab.—Persia, Afghanistan, Nepal, Cashmere, and Europe.

ORCHIS LAXIFLORA, *Lam.*

Fig.—? *Boiss. Fl. Orient. v.*, p. 71.

Hab.—Persia and Afghanistan. The tubers.

Vernacular.—Salab-misri, Salap-misri (*Hind.*), Shâlá-mishiri (*Tam.*), Sálá-misiri (*Tel.*), Sálá-mishri (*Mal.*), Chále-michhri (*Beng.*), Sálama-misri (*Mar.*, *Guz.*).

History, Uses, &c.—Theophrastus (P. H. ix., 19), and Dioscorides (iii., 132, 133, 134, 135), mention several tuberous roots which were used by the Greeks under the names of Orchis or Serapias and Satyrion. It is not known exactly what all of these were, but it is certain that some of them were the tubers of different species of Orchis. Ορχις is described by the ancients as having a twofold root, formed of tuberosities which resemble the testes in appearance. The larger of these tuberosities, or, as some say, the harder of the two, taken in water, was thought to be provocative of lust; while the smaller, or, according to some, the softer one, taken in goat's milk, was considered to be antaphrodisiac. The tubers were also used as a remedy for ulcerations of the mouth and pituitous discharges from the chest, and were taken in wine as an astringent.

Mahometan physicians describe Orchis tubers under the name of Khusyu-uth-thalab (or salab), "foxes' testicles," and state that the odour of them, when fresh, resembles that of *semen hominis*, and that they have an aphrodisiac effect if clasped in the hand. The dried tubers have a great reputation in the East as a nervine tonic and restorative, and are much prescribed in paralytic affections. It was formerly supposed that Oriental Salep was obtained from certain species of Eulophia, but the tubers of these plants have no resemblance to the commercial article, and Aitchison has now established the fact that the two plants placed at the head of this article yield the bulk of the Persian salep. *Eulophia campestris*, Wall., is, however, used locally in Northern India as a substitute for salep.

In Southern India the tubers of several species of Habenaria and Orchis are collected by people in the hilly districts and sold locally as salep, but they are usually small and variable in appearance.

Salep is now regarded in Europe as very nutritious; it tends to confine the bowels, and is, therefore, a useful article of diet for those who suffer from diarrhœa.

The mucilage is prepared by first macerating powdered salep in cold water, and gradually adding boiling water, with stirring, in the proportion of 5 grains of salep to the ounce. Instead of water, milk or some animal broth may be used. Salep jelly may be made as follows: Rub 60 grains of powdered salep with water in a mortar until it has swollen to four times its original bulk; then add gradually, and with constant stirring, 16 ounces of boiling water, and boil down to 8 ounces.

Ainslie states that salep has the property of depriving salt-water of its salt taste.

Description.—Oriental salep is of two kinds, palmate and ovoid; the former, which was once known in Europe as *Radix palmæ Christi*, is very highly esteemed by the Persians, especially if of large size. The ovoid tubers are from 1 to 1½ inches in length, and, if of good quality, have a creamy white colour, or are somewhat translucent and of a horny texture. They have hardly any odour and an insipid mucilaginous taste. The tubers should be plump and not wrinkled. When magnified, the bulk of the tuber is seen to consist of a parenchyme, the cells of which contain either mucilage, or starch altered by heat; it is traversed by small fibro-vascular bundles.

Chemical composition.—The most important constituent of salep is a sort of mucilage, the proportion of which, according to Dragendorff (1865), amounts to 48 per cent.; but it is, doubtless, subject to great variation. Salep yields this mucilage to cold water, forming a solution which is turned blue by iodine, and mixes clearly with neutral acetate of lead like gum arabic. On addition of ammonia, an abundant precipitate is formed. Mucilage of salep precipitated by alcohol and then dried, is coloured violet or blue, if moistened with a solution of iodine in iodide of potassium. The dry mucilage is readily soluble in ammoniacal solution of oxide of copper; when boiled with nitric acid, oxalic, but not mucic, acid is produced. In these two respects, the mucilage of salep agrees with cellulose, rather than with gum arabic. In the large cells in which it is contained, it does not exhibit any stratification, so that its formation does not appear due to a metamorphosis of the cell-wall itself. Mucilage of salep contains some nitrogen and inorganic matter, of which it is with difficulty deprived by repeated precipitation by alcohol.

It is to the mucilage just described that salep chiefly owes its power of forming with even 40 parts of water a thick jelly, which becomes still thicker on addition of magnesia or borax. The starch, however, assists in the formation of this jelly; yet its amount is very small, or even *nil* in the tuber bearing the flowering stem, whereas the young lateral tuber abounds in it. The starch so deposited is evidently consumed in the subsequent period of vegetation, thus explaining the fact that tubers are found the decoction of which is not rendered blue by iodine. Salep contains also sugar and albumin, and, when fresh, a trace of volatile oil. Dried at 110° C., it yields 2 per cent. of ash, consisting chiefly of phosphates and chlorides of potassium and calcium. (*Pharmacographia.*) Gans and Tollens have tested the oxidation products, and in *Annales*, **249**, 245 (*J. Chem. Soc.*, May 1889), they report : "On oxidation salep yields saccharic acid, but no mucic acid. No furfuraldehyde is obtained by distilling salep syrup with dilute acids. With phenylhydrazine and sodium acetate it forms a precipitate which can be separated by crystallization from the phenylhydrazine compounds of dextrose and mannose, results which show that the syrup contains dextrose and mannose, but neither galactose nor arabinose."

Commerce.—In Eastern markets salep is classed as palmate and non-palmate. The former kind only appears in small quantities, and is much more highly valued than the latter; in Persia it is called *Panjeh-i-sálab*, or "hand salab," a name which is corrupted into *Punjábi* in India. The ordinary salep of commerce is known as *Abushaheri* or *lasaniya*, "garlic-like"; it sells at Rs. 30 to 35 per maund of 41 lbs., according to quality, whilst the palmate variety fetches fancy prices; if very fine and white, from 5 to 10 rupees per lb. may be asked for it.

The salep of Madras is largely supplied from the Nilgiris, where it is collected by the Todas and other hill tribes. The tubers are boiled in water, and then dried in the sun until quite hard, and are sent into the market in coarse bags containing five maunds. In Ootacamund this salep sells for Rs. 5 to Rs. 6 a maund of 25 lbs., and in Madras it realizes about twice the price. Mahomedans all over Southern India use this salep for making conjees and the sweetmeat *hulwa.*

Imitation salep is largely manufactured in India; it is known as *Banawati salab* or *salam*, and is said to be made of pounded potatoes and gum.

EULOPHIA VIRENS, *Br.*

Fig.—*Bot. Reg.*, *t.* 573; *Wight Ic.*, *t.* 913; *Bot. Mag.*, *t.* 5579; *Roxb. Cor. Pl.* i., *t.* 38; *Rheede, Hort. Mal.* xii., *tt.* 25, 26.

Hab.—Bengal and Deccan Peninsula.

EULOPHIA CAMPESTRIS, *Wall.*

Hab.—Plains of India, Punjab, Oudh, Bengal, and Deccan.

EULOPHIA NUDA, *Lindl.*

Fig.—*Wight Ic., t.* 1690; *Rheede, Hort. Mal. xii., t.* 26?

Hab.—Tropical Himalaya and Deccan Peninsula. The tubers.

Vernacular.— Mán-kand, Amber-kand, Bhui-kákali (*Mar.*), Katou-kaida-maravara, Katou-theka-maravara (*Mal.*), Budbar, (*Beng.*), Goruma (*Hind.*).

History, Uses, &c.—The tubers of these plants are used indiscriminately by the natives. The vernacular name *Mán-kand* is derived from the Sanskrit *Manya*, which signifies "the neck," and the plant is so named from a supposed resemblance between its tubers and scrofulous glands in the neck; Mán (मान), the Marathi form of the word, is also applied to the scrofulous disease in the neck. The tubers are applied externally and given internally to remove the disease. They are also administered internally to those suffering from intestinal worms. Rheede says of *E. virens*:—"Succus radicis si supra arborem *Kansjira* inveniatur amarus est, alvum laxat, bilem promovet. Succus bulbi et foliorum omnem adustionem ex pulvere pyrio, oleo ferventi, vel igne causatam, cum sanguine canino mixtus, tollit. Pulvis venenum, sive externum sive internum expellit. Si supra arborem *Java*, vermes intestinorum enecat, febri resistit, ventrioulum corroborat, flatus dissipit. Succus cum carne totius plantæ in formam cataplasmatis redactus apostemata emollit, et, sine dolore, ad maturitatem producit." Roxburgh describes *E. virens* under the name of *Limodorum virens*, but does not notice its medicinal uses. Aitchison (*Notes on Products of W. Afghanistan and N. E. Persia*, p. 68) says:—"*E. campestris* is by no means rare in the Punjab, Baluchistan, and Afghanistan. Its tubers are collected in the Punjab, and make up the ordinary Salep of Lahore. When the present railway bridge was being constructed over the Chenab, at Wazirabad, some of the islands over which the bridge was built were one season covered with this Orchis, specimens of which were sent to me by Captain Clerk, and which are now in the Herbarium at Kew."[1] A parcel of the tubers of *E. campestris* was sent to one of us from the Native State of Sirohi, with the object of ascertaining their commercial value if collected as Salep; they were similar in form to those of *E. nuda*, but smaller, and bore no resemblance to the commercial article.

Description.—The tubers of *E. virens* are conico-obpyriform, surrounded with circular marks showing the insertions of old leaves; if they have been exposed to the air, as is often the case with the upper portion of the tuber, they are of a greenish colour, when not so exposed of a yellowish white. In the fresh state many fleshy fibres issue from the lower portion of the tuber. *E. nuda* has larger tubers, often much flattened, in structure and colour they resemble those of *E. virens*, the leaves are larger, and the flowers often purple, though in some specimens they are green like those of *E. virens*. The tubers of *E. campestris* are of a similar character. Under the microscope the gum cells are seen, and the exterior cells contain bundles of raphides. The small tubers exhibit starch granules, but in large tubers these are entirely absent.

Chemical composition.—The fresh tubers contain a large quantity of clear white mucilage, which is not precipitated by ferric chloride or neutral acetate of lead, but is precipitated by basic acetate of lead and alcohol. The mucilage, unlike that of salep, is not coloured violet by iodine solution. Nitric acid forms no mucic acid when allowed to act upon the gum. The ash of the dried tubers amounted to 3·6 per cent.

DENDROBIUM MACRAEI, *Lindl.*

Fig.—*Xen. Orchid. ii., t.* 118.

Hab.—Sikkim, Khasia Mts., The Concan, and Nilgiri Hills. The plant.

Vernacular.—Jivanti, Jiba-ság (*Hind.*), Jibai, Jibanti (*Beng.*), Jivanti (*Mar.*, *Guz.*).

History, Uses, &c.—This plant is the Jivanti of Sanskrit writers. In the Nighantás it bears the synonyms of Jivani, Jiva "life-giving," Jivaníyá "supporting life," Jiva-sreshtha, Sáka-sreshtha "best of herbs," and Yasas-vini "renowned." It is also spoken of as Jiva-bhadra and Mangalya "auspicious," and is described as cold, mucilaginous, light, strengthening, and *tridosha-ghna*, *i.e.*, a remedy for the disorder of the three humors of the body, bile, blood and phlegm, known to Hindu physicians as *tridosha*. The whole plant is used in decoction along with other drugs supposed to have similar properties; it must not be confounded with *Jivaka*, one of the *Ashtavarga*, which is a drug unknown to the modern Hindus. *D. Macraei* does not appear to have been noticed by any of the European writers upon Indian Materia Medica.

Description.—A much-branched plant, often found on Jambul trees; stems long and pendulous, knotty, and with many oblong pseudo-bulbs; leaf one, terminal, shortly oblong, on the terminating pseudo-bulb, four to eight inches long, sessile; flowers white, side lobes of lip sprinkled with red, solitary at the base of the leaf, one in front and one behind; middle lobe of the lip much dilated, and the disk with two longitudinal fleshy crests. This plant has from its coloration been well named *pardalinum* or panther-like by Reichberg.

Chemical composition.—The alcoholic extract of the dried roots and stems was mixed with water acidulated with sulphuric acid and agitated with petroleum ether, ether, and then rendered alkaline and reagitated with ether. The petroleum ether extract had an aromatic odour, and was of a yellow colour and soft consistence. In cold absolute alcohol the greater part dissolved with acid reaction; the insoluble residue was white, and had the characters of a wax. During agitation with petroleum ether, chocolate flocks separated.

The acid ether extract formed a waxy, transparent red varnish, which repelled water, and was insoluble in it. In absolute alcohol the extract dissolved with strong acid reaction. The extract was treated with caustic soda and agitated with ether. The ether extract formed a yellow varnish indistinctly crystalline in places. By the action of acidulated water traces of an alkaloid were separated. The extract when acted upon by cold absolute alcohol afforded a bright yellow solution without bitter taste; the portion of the extract insoluble in cold alcohol was white, by heating with alcohol it dissolved, and on cooling white woolly flocks separated, which on microscopic examination presented the appearance of interlaced hair-like masses. The amount of this principle was very small and its nature could not be determined. The alkaline solution of the original ether extract was acidulated and reagitated with ether, which left on separation a red transparent waxy varnish, insoluble in water, easily soluble in cold absolute alcohol with strong acid reaction and bitter taste. This principle had the properties of a resin acid, and we propose terming it β *Jibantic acid.* The alkaline ether extract contained traces of a white alkaloid without bitterness, crystallizable from ether, and giving a faint yellow coloration with Fröhde's reagent in the cold, deepening slightly on warming; no reaction with nitric acid. We provisionally call this alkaloid *Jibantine.* This alkaloid appeared similar to the one contained in the acid ether extract.

The chocolate-coloured flakes referred to as having separated on agitation with petroleum ether, were repeatedly agitated with ether, which on evaporation afforded a small amount of extractive similar to the original acid ether extract. The insoluble flocks were then dissolved in caustic soda and reagitated with ether, the ether affording a small amount of extractive. The alkaline solution was rendered acid and reagitated with ether, which separated a certain amount of a bitter acid resin, similar to the one we have termed β Jibantic acid, while chocolate flocks remained insoluble.

β Jibantic acid when freshly precipitated from an alkaline solution by acids would appear to be easily soluble in ether, but the flocks after standing become less soluble. The chocolate flocks just referred to were repeatedly agitated with ether, dissolved in caustic soda, precipitated with acid, and reagitated with ether, in order to separate β Jibantic acid. Finally the flocks insoluble in ether were dissolved in alcohol, which afforded a red solution with only sight bitterness. We provisionally call this acid α *Jibantic acid.*

The chief points of difference and resemblance between these two acids may be summarized thus—bitterness, and easy solubility of the β acid, when freshly precipitated, in ether: slight bitterness and insolubility of the α acid, when freshly precipitated, in ether. The β acid is precipitated in lighter coloured flocks from an alkaline solution than the α acid. Both acids are soluble with equal readiness in alkalies and cold absolute alcohol.

VANDA ROXBURGHII, *Br.*

Fig.—*Bot. Reg., t.* 506; *Wight Ic., t.* 916; *Fl. des Serres*, ii., *t.* 11; *Reichb. Fl. Exot., t.* 121.

Hab.—Bengal, Behar, Guzerat, Concan to Travancore. The roots.

SACCOLABIUM PAPILLOSUM, *Lindl.*

Fig.—*Bot. Reg., t.* 1552.

Hab.—Bengal and the Lower Himalaya, Assam, the Gangetic Delta, the Circars and Tenasserim. The roots.

Vernacular.—Rásna (*Ind. Bazars*).

History, Uses, &c.—We have already stated (Vol. ii, p. 260) that we consider it probable that the original Rásna of the Arians was *Inula Helenium*, as the two drugs at the head of this article are notably deficient in the properties ascribed to Rásna by Sanskrit writers; for instance, the plants under consideration cannot be described as Gandha-mula "having a strong smelling root." Dutt (*Mat. Med.*, p. 258) remarks:—"Under the name of *rásna*, the roots of *Vanda Roxburghii* and *Acampe papillosa* are both indiscriminately used by native physicians. They are very similar in the appearance of their roots and leaves, though they differ much in their flowers and fruit. One native physician whom I consulted, pronounced both of these plants to be *rásna*; when, however, I showed him the different flowers and fruit of the two species, he was puzzled." The description of the properties and uses of rásna will, we think, convince our readers that the original drug was not what is now used.

Rásna is said to be bitter and fragrant, and useful in rheumatism; the *Rásnapanchaka* is a decoction of *rásna; Tinospora cordifolia*, wood of *Cedrus Deodara*, Ginger, and root of *Ricinus communis*, of each equal parts; it is a popular prescription for rheumatism. *Rásna guggulu* is a *ghrita* composed of eight parts of *rásna* and ten of bdellium beaten into a uniform mass with clarified butter; it is given in drachm doses in sciatica. *Rásna* is also an ingredient of several oils used for external application in rheumatism and neuralgia, such as *Mahámásha taila, Madhyama Naráyana taila, &c.* *Vanda* is a general name in Sanskrit and the vernaculars for parasitic plants; other Sanskrit names for these plants are *Vrikshádani* and *Vriksharuha* "growing on trees." They are further distinguished by the addition of the names of the tree on which they grow, thus *Amara-vanda* would signify the *Vanda* of the *Amara* or mango.

Description.—*V. Roxburghii.*—Stem climbing, 1—2 feet; leaves 6 to 8 inches long, præmorse, narrow, complicate; peduncle 6 to 8 inches, 6 to 10-fid; sepals and petals yellowish-green or bluish, except from the clathrate-brown nerves, margins white, lip half as long as the sepals or more, disk of mid-lobe convex with fleshy ridges and white margins and mesial lines, spur conical.

S. papillosum.—Stem climbing, 2 to 3 feet; leaves 3 to 4 inches long, obliquely notched, narrow, complicate; scape 1 to 2 inches, closely scarred at the base, internodes close, bracts semicircular; flowers ⅔ of an inch in diameter, mid-lobe of lip ovate, spur conical, pubescent within, petals yellow marked with red lines, lip white.

In the Concan *S. Wightianum*, Hook. f., *Rheede, Hort. Mal.* xii., *t.* 4, and *S. præmorsum*, Hook. f. *Rheede, Hort. Mal.* xii., *t.* 4, very similar plants, are used as Rásna. The Marathi peasants call these plants *Kánbher.*

Ordinary bazar Rásna both in Calcutta and Bombay consists of long branching roots, having something the appearance of sarsaparilla, but of a dark greyish-brown colour. The bark is thin and marked by numerous longitudinal furrows, the substance of the root light-brown and very fibrous; a transverse section shows the woody portion to be arranged in wedge-shaped bundles. The root is inodorous, and has a starchy bitterish and astringent taste.

In Bombay a second kind of Rásna is sold at a much higher price, which bears no resemblance to the ordinary commercial article; it occurs as straight pieces of a root about the size of a crowquill at the thickest part, gradually tapering to a point, and tied up in small bundles with thread. This root is of a light brown colour, with a thick and very hard bark; it has a faint peculiar odour when powdered, which recalls that of ipecacuanha. It is called *Khadaki-rasna* in Bombay. Under this name we have also received the roots of *Tylophora asthmatica.*

Chemical composition.—The standard *Rásna* of the Indian bazars yielded the following principles when an alcoholic extract of the whole dried plant was treated in a similar manner to that described under *Jibanti* p. 390: α—resin acid of a chocolate colour, insoluble in petroleum ether and ether: β—resin acid soluble in ether: neutral yellow resin: an alkaloidal principle: a white neutral principle: a neutral fluorescing principle. In physical and chemical properties the first five principles were similar to those described under *Jibanti.* An examination of the more expensive *Rásna* of the Bombay market gave the following results:—

A tincture prepared with 80 per cent. alcohol, gelatinized on concentration, after separation of the whole of the alcohol, the extract was agitated with amylic alcohol, and water acidulated with acetic acid. Amylic alcohol was selected for the first extraction, because preliminary experiments indicated that when petroleum ether or ether was used for agitation with an aqueous solution of the alcoholic extract, the liquid formed an emulsion which showed little or no tendency to separate. The amylic alcohol tincture was evaporated on a water bath, and, when dry, was repeatedly agitated with ether, until colouring matter ceased to be dissolved. The extract insoluble in ether was then redissolved in amylic alcohol and agitated repeatedly with baryta water, until the baryta water ceased to be colored yellow. During agitation a soft varnish-like mass separated and adhered to the sides of the bottle. By this treatment the original amylic alcohol extract was separated into three fractions: (1) The amylic alcohol solution, (2) the varnish-like residue adhering to the sides of the bottle, and (3) the baryta water solution.

(1) The amylic alcohol solution on evaporation left a solid residue, which, after being pounded, and agitated with ether, to remove traces of adherent amylic alcohol, possessed the properties of a saponin-like principle; it frothed considerably with water; treated with concentrated sulphuric acid, a dirty reddish coloration was slowly developed; in water and aqueous ammonia it was only slightly soluble, but dissolved easily in ordinary acetic acid. As extracted the principle was not pure, it contained colouring matter and barium.

(2) The varnish-like residue was dissolved in acetic acid and agitated with amylic alcohol, the extract being treated with ether to remove traces of amylic alcohol. This extract also behaved like a saponin-like principle: after purification it formed a yellowish powder, it frothed considerably with water; treated with concentrated sulphuric acid, it developed in a shorter period than the first extract a beautiful bright carmine coloration: in water it was easily soluble, a concentrated solution having much the physical appearance of an aqueous egg albumen, and it dissolved readily in aqueous ammonia.

(3) The baryta water solution contained much colouring matter and a small amount of a principle which frothed with water, which was probably a mixture of the two principles already mentioned.

The original aqueous solution of the alcoholic extract left after agitation with amylic alcohol was acidulated with acetic acid and agitated with ether. The ether extract contained a neutral resin-like principle, a very bitter resin acid, the bitter taste of the drug being probably due to this resin, and a white crystallizable acid.

Finally, the acid aqueous solution was treated with sodic carbonate in excess and reagitated with ether. The ether separated traces of an alkaloidal principle, which afforded a faint yellow coloration with Fröhde's reagent, deeping slightly on heating.

Vanda spathulata, *Spreng.*, is the *Ponnampou-mara-vara* of Rheede (12, 3), and is supposed on the Malabar Coast to temper the bile and abate phrenzy, and the golden yellow flowers, reduced to powder, are given in consumption, asthma, and mania. (See Ainslie, *Mat. Med.*, ii., 321.)

Rhynchostylis retusa, *Blume*, is also mentioned by Rheede (xii., 1), also **Cymbidium tenuifolium** (xii., 5 and 6) and *C. ovatum* (xii., 7), as emollients. **C. aloifolium** (xii., 8) is said to be emetic and purgative.

SCITAMINEÆ.

CURCUMA AROMATICA, *Salisb.*

Fig.—*Salisb. Parad., t.* 96; *Rosc. Scit., t.* 103; *Wight Ic., t.* 2005; *Bot. Mag., t.* 1546. Wild Turmeric, Yellow Zedoary, Cochin Turmeric (*Eng.*), Zedoaire jaune (*Fr.*).

Hab.—Throughout India, wild and cultivated. The tubers.

Vernacular.—Jangli-haldi, Ban-haldi (*Hind.*), Ban-halad (*Beng.*), Rán-halad, Vedi-halad (*Mar.*), Amba-halad (*Guz.*), Kashturi-manjal (*Tam.*), Kasturi-pasupa, Kattu-mannal (*Tel.*), Kasturi-arishina, Kad-arishina (*Can.*).

History, Uses, &c.—This plant is the Vana-haridra or "wild turmeric" of Sanskrit writers. The Arabian and Persian physicians do not notice it, and probably did not distinguish it from turmeric. Roxburgh and Ainslie wrongly supposed it to be the Jadwar of the Arabians (see Vol. I., p. 20). It is the turmeric-coloured zedoary of Ainslie, who states that the Mahometans of Southern India suppose it to be a valuable medicine in snake-bite, administered in conjunction with golden orpiment, costus, and ajwain seeds. Guibourt (ii., p. 214) calls it *Zedoaire jaune*, and states that the plant which produces it has been well described and figured by Rumphius, and is his *Tommon bezaar* or *Tommon primum*, which has been wrongly referred by most writers to the *Curcuma Zedoaria* of Roscoe. *C. Aromatica* is identical with the Cassumunar described by Pereira (*Mat. Med.*, Vol. II., Pt. I., p. 236), and the "Cochin Turmeric" noticed by Flückiger and Hanbury (*Pharmacographia*, p. 580). The properties of this drug are very similar to those of turmeric, but its flavour being strongly camphoraceous is not so agreeable. It is used medicinally by the Hindus, in combination with other drugs, as an external application to bruises, sprains, &c., and is applied to promote the eruption in the exanthematous fevers; it is seldom used alone, but is combined with astringents when applied to bruises, and with bitters and aromatics to promote eruptions; it is never used as a condiment in India, but a kind of arrowroot is prepared from the tubers in Travancore. The plant under favourable circumstances produces central tubers as large as a small turnip. One of us has had it under cultivation for some years; the leaves when young have a central purple stain, which almost disappears when they attain their full size. The flowers appear in May or June, with the first leaves, just before the the rainy season.

Description.—Central rhizome oblong or conical, often more than two inches in diameter, external surface dark-grey, marked with circular rings and giving off many thick rootlets; at the ends of some of them are orange-yellow tubers about the size and shape of an almond in its shell; lateral rhizomes about as thick as the finger, with a few fleshy rootlets. Internally both central and lateral rhizomes are of a deep orange colour like turmeric; the odour of the root is strongly camphoraceous.

Microscopic structure.—Similar to that of turmeric.

Chemical composition.—The drug yielded to analysis:—

Ether extract (essential oil, fat, and soft resins)...	12·06
Alcoholic extract (sugar, resins)	1·14
Water extract (gum, acids, &c).	6·50
Starch	23·46
Crude fibre	8·42
Ash	4·46
Moisture	13·33
Albuminoids, modifications of arabin, &c.	30·63
	100·00

The root had an odour of ginger; curcumin was present. The water extract gave a crystalline precipitate with lead acetate, which was found to be due to the presence of malic acid.

Commerce.—The plant is chiefly grown at Alwaye, North-east of Cochin, and is also collected in Mysore, Wynaad, and other localities in Southern India for export to Europe as a substitute for turmeric to be used in dyeing. It is exported from Cochin and Bombay. Value, Rs. 24 to 25 per candy of 5¼ cwts. for the unpeeled root, Rs. 27 to 28 when peeled.

A European firm of Druggists in Bombay, writing to London for the ingredients to make Warburgh's fever tincture, was supplied with this article as Zedoary.

Exports of Turmeric from Cochin:—

	Europe, &c.	India, Burma, &c.	Total cwts.
1884-85	5,154	6,361	11,515
1885-86	7,610	2,776	10,386
1886-87	6,031	1,967	7,998
1887-88	2,356	2,039	4,395
1888-89	459	1,817	2,276
1889-90	2,013	6,704	8,717

CURCUMA ZEDOARIA, *Rosc.*

Fig.— *Rosc. Scit.*, *t.* 109; *Roxb. Cor. Pl.*, *t.* 101; *Rheede, Hort. Mal.* *xi.*, *t.* 7. Zedoary (*Eng.*), Zedoaire (*Fr.*).

Hab.—Eastern Himalaya, cultivated throughout India. The tubers.

Vernacular.—Kachúra (*Hind.*, *Beng.*, *Mar.*, *Can.*, *Guz.*), Kichilick-kizhanghu, Pulan-kizhanga (*Tam.*), Kichili-gaddala, Kachoram (*Tel.*), Kacholam, Kachuri-kizhanna, Pula-kizhanna (*Mal.*).

History, Uses, &c.—This plant is the Sati and Krachura of Sanskrit writers, and the Zerumbád and Urúk-el-káfúr, "camphor root," of the Arabians. It is noticed by the later Greek physicians under the name ζουρομβέδ, a corruption of the Arabic name, which, in the Middle Ages, was variously written as Zeruban, Zerumber, and Zerumbet. It is not the ζέδοαρ of Ætius (A. D. 540—550) or the τζετδυαριον of Myrepsus, or the Zedoar of Macer Floridus (A. D. 1140). Barbosa (1516) speaks of *Zedoaria* and *Zeruban* as distinct articles of trade at Cannanore, so that it must have been some time after this date that Zerumbet came into use in Europe as a cheap substitute for the Zedoar of the earlier physicians, which, we have no doubt, was the same drug as the Jadwar of the Arabians. This name, correctly written by Ætius, is the ژد وار (Zhedwar) of the ancient Persians, and is described in the *Burhán* (A. D. 1046) as a drug used as an antidote to poisons, the same as the Jadwár of the Arabians, and also called *Mahparvin.* Ibn Sina of Bokhara, who lived about the same time (980—1037), describes Jadwár shortly in the following words:—
الماهية قطع يشبه الزراوند و ادق منه —"it has the form of the root of Aristolochia, but is smaller." Haji-Zein-el-attár, the well-known Persian physician and apothecary, and the author of the "Ikhtiarát" (A. D. 1368), describes Jadwár as a root about the size and shape of the Indian Cyperus root, but harder and heavier, and the same as the Indian drug Nirbisi, the best internally of a purplish tint. He states that there

are, as far as his experience goes, four drugs sold as Jadwár, viz., a white kind, a purplish, a black and a yellow; the people of Cathay call the yellow kind *Kurti* and the purplish *Burbi*, the other two kinds come from India. As to the locality in which the drug is collected, he states that there is a mountain called Farájal between India and Cathay, where the plant grows along with the aconite, and that the latter, whenever it grows near the Jadwár, loses its poisonous properties and is eaten with impunity by the inhabitants. Where the Jadwár does not grow, the aconite (Bish) is a deadly poison, and is called *Halâhal* by the natives (Halahala, Sanskrit). In the *Dict. Econ. Prod. of India* (ii., p. 656), the following interesting account of certain drugs collected in Nepal by Dr. Gimlette, the Residency Surgeon, substantially confirms Haji-Zein's description of Jadwár or Nirbisi:—According to Dr. Gimlette, "the *Kala bikh* of the Nepalese (the *Dulingi* of the Bhoteas) is a very poisonous form of *Aconitum ferox*, so poisonous, indeed, that the Katmandu druggists will not admit they possess any. *Pahlo* (yellow) *bikh* is a less poisonous form of the same plant, known to the Bhoteas as *Holingi*, while *Setho* (white) *bikh* (the *Nirbisi sen* of the Bhoteas) is *A. Napellus*, and *Atis* is *Aconitum heterophyllum*. The aconite adulterants or plants used for similar purposes are, *Cynanthus lobatus*, the true *Nirbisi* of Nepal, the root of which is boiled in oil, thus forming a liniment which is employed in chronic rheumatism, *Delphinium denudatum*, the *Nilo* (blue or purplish) *bikh* of the Nepalese and the Nirbisi of the Bhoteas, Dr. Gimlette says, is used by the *Baids* of Nepal for the same purposes as the *Setho* and *Pahlo bikh*. *Geranium collinum* (*var-Donianum*) is the *Ratho* (red) *bikh* of the Nepalese, and the *Nirbisi-num* of the Bhoteas, and, like the *Setho bikh*, is given as a tonic in dyspepsia, fevers, and asthma. Lastly, a plant never before recorded as used medicinally, namely, *Caragana crassicaulis*, is known as the *Artiras* of the Nepalese, and the *Kurti* of the Bhoteas; it affords a root which is employed as a febrifuge."

The Jadwár or Nirbisi myth appears to have been invented in the East to account for the curious occurrence on the

Himalayas of poisonous and non-poisonous aconites growing side by side (see Vol. I., pp. 1, 15, 18, 20).

It would appear also that the Curcumas have no claim to the name of zedoary, which was probably first given to them about the middle of the 16th century, as Clusius's figure of Gedwar is certainly meant for the pendulous tuber of a Curcuma. The substitution of the cheaper for the more expensive article is rendered highly probable by the fact that Zerumbet was considered by the Arabians to be very little inferior to Jadwár as an antidote to poisons. Ibn Sina, Ibn Baitar, and Ibn Jazla in the *Minháj* use almost the same words in speaking of these drugs; of Jadwár they say:—هو ترياق السموم باسرها حتي البيش والافاعي, "it is an antidote for all poisons, even those of aconite and the viper"; and of Zerumbet—من ينفع لنزع الهوام جدا حتي يقارب الجدوار "it is most useful against the bites of venomous animals, and is almost equal to Jadwár." Both drugs were considered to have properties similar to *Darunaj* (see Vol. II., p. 292). Ainslie (*Mat. Ind.*, i, 492) remarks that *C. Zedoaria* is the *Lampooyang* of the Javanese, and the *Lampuium* of Rumphius (*Herb. Amb*, V., p. 148), and that it is a native of the East Indies, Cochin-China, and Otaheite. He quotes Geoffroy's description of the drug, which leaves no doubt as to its identity with the modern Kachora—"Foris cinerea, intus candida; sapore acri-amaricante aromatico; odore tenui fragrante, ac valde aromaticum suavitatem, cum tunditur aut manducatur, spirante et ad camphoram aliquatenus accedente." Guibourt states that *C. Zedoaria* is the Zerumbet of Serapion, Pomet, and Lemery. The following is his description of it:—"The round zedoary is greyish-white externally heavy, compact, grey and often horny internally, having a bitter and strongly camphoraceous taste, like that of the long zedoary, which it also resembles in odour. The odour of both drugs is analogous with that of ginger, but weaker unless the rhizome be powdered, when it developes a powerful aromatic odour, similar to that of cardamoms." (*Hist. Nat.* 6^{me} Ed., Vol. II., p. 213.) In our opinion there is no doubt that *C. Zedoaria* is the source of the round and long zedoary of commerce. The plant is common in Bombay gardens, and was probably introduced by the Portuguese, whose descendants and converts at the present day use the leaves in cookery, especially with fish. From Dr. Hové's account of Bombay in 1787 it appears that Kachúra and Turmeric were cultivated at that time in the cocoanut woods at Mahim. The natives chew the root to correct a sticky taste in the mouth; it is also an ingredient in some of the strengthening conserves which are taken by women to remove weakness after child-birth. In colds it is given in decoction with long-pepper, cinnamon and honey, and the pounded root is applied as a paste to the body. Rheede says that the starch of the zedoary is much esteemed, and that the fresh root is considered to be cooling and diuretic, it checks leucorrhœal and gonorrhœal discharges and purifies the blood. The juice of the leaves is given in dropsy. One of us has had the plant in cultivation for some years; it blossoms in the hot weather just before the rains, when the first leaves begin to appear.

Description.—Guibourt's description already given agrees exactly with the Kachúra of India, but it is often cut into transverse slices instead of into halves and quarters.

Microscopic structure.—This is essentially the same as that of turmeric, but the resin and essential oil in the cells is of a yellowish-white colour, and the greater portion of the starch grains are ovoid or pyriform, instead of narrow and elongated as in turmeric.

Chemical composition.—Zedoary contains, according to Bucholz (*Repert. Pharm. xx.*, 376), volatile oil, a bitter soft resin, a bitter extractive matter, gum, starch, &c. The oil is turbid, yellowish-white and viscid, has a camphoraceous taste and smell, and consists of two oils, one lighter, the other heavier than water. Trommsdorff obtained from the root a substance which he called *Zedoarin*, but did not further describe it. A proximate analysis afforded:—

Essential oil, resin, curcumin, &c.	3·79
Resins, sugar	·90
Gum and organic acids	15·22
Starch	17·20

Crude fibre	10·92
Ash	6·06
Moisture	10·31
Albuminoids, Arabins, &c.	35·60
	100·00

Commerce.—The Bombay market is supplied from Ceylon. Value, Rs. 20 to Rs. 30 per candy of 7 cwts. The drug is chiefly used in India as a cosmetic. Roxburgh states that Bengal is supplied from Chittagong.

CURCUMA CÆSIA, *Roxb.*

Hab.—Bengal. Often cultivated. The tubers.

Vernacular.—Nar-kachúra, Káli-haldi (*Hind.*, *Guz.*), Káli-halad (*Mar.*), Káli-halad, Nilkanth (*Beng.*), Mána-pasupu (*Tel.*).

History, Uses, &c.—This drug is one of the two Zerumbáds of modern Persian writers on Materia Medica. Strange to say, it is not noticed by most European writers on Indian drugs, though it is well known and to be found in all the shops. It is the *Tommon itam* of Rumphius, and the *Curcuma long.* of Guibourt, who classes it with the turmerics. See *Hist. Nat.*, II., p. 210, 6^{me} Ed., where a figure will be found. Guibourt's description is as follows:—"Ce curcuma est en tubercules cylindriques, c'est-à-dire qu'il conserve sensiblement le même diamètre dans toute sa longueur, malgré ses différentes sinuosités. Il est plus long que le précédent, mais beaucoup plus mince, n'étant jamais gros comme le petit doigt; sa surface est grise, souvent un peu verdâtre, rarement jaune, chagrinée, ou plus souvent nette et unie. Il est à l'intérieur d'une couleur si foncée qu'il en parait rouge-brun, ou même noir. Il a une odeur aromatique très dévelopée, analogue à celle du gingembre; sa saveur est également très aromatique et cependant assez douce et nullement amère. Il est impossible de méconnaitre dans cette racine les articles digités du *Curcuma domestica minor*. Enfin, on trouve dans le curcuma du commerce, mais en petit quantité, des tubercules ronds de la grosseur d'une aveline, souvent didymes, ou offrat les restes de deux stipes foliacés. Ces tubercules offrent d'ailleurs tous les caractères des précédents, et sont les *matrices radicis* du *Curcuma domestica minor.*" Nar-kachùra appears to have been once imported into Liverpool under the name on *Kutchoo*. (*Phar. Jour.* (II.), Vol. I., p. 17.) Aitchison (*Notes on Prod. of W. Afghanistan and N. E. Persia*, p. 51) remarks:—"Zedoary, *jidwár*, *jizwar*, *kachur*, *kachul*, is imported in quantity from India, most of it to be passed on to Turkistan. The long tubers are called *nar-kachul*, and the round ones *mada-kachul*, as if they were the products of two different plants, but I have only seen them mixed together, and not sold as two distinct roots. The Turkomans employ these roots as a rubefacient, to rub their bodies down with after taking a Turkish bath. In this part of the country, in lieu of these, the nodes on the roots of *Eremostachys labiosa* and another species are collected and sent on to Turkistan. Curcuma roots are employed a little in native medicine, and as a condiment."

The plant is a native of Bengal, and is cultivated there to supply the Indian market. Nar-kachúra is considered to have nearly the same medicinal properties as Kachúra; it is chiefly used as a cosmetic. The author of the *Makhzan* describes it as a kind of Zerumbád. (See *Makhzan*, article "Zerumbád.") Through the kindness of Surgeon-Major Peters we have been supplied with living tubers of this Curcuma from Dinapore; he informs us that it is common in gardens in Bengal, and is used as a domestic remedy in the fresh state much as turmeric is in this part of India. The fresh tubers are of a pale yellow colour, but after boiling and drying we find that they assume the *couleur foncée* of the drug found in the shops.

Description and Microscopic structure.—The minute structure of this tuber hardly differs from that of the zedoary. The starch contained in the cells of the parenchyme has been altered by heat, and appears as a finely granular mass nearly filling the cell. The resin cells are about as numerous as in the zedoary, but the contents are of a dusky orange colour. The vascular system consists of scalariform and spiral vessels. As to the drug, it consists of small nearly globular central tubers, from which spring numerous lateral rhizomes about the size of ginger. It is of a dark-grey colour externally and marked with circular rings. Internally it is very hard and horny, of a greyish black, but when cut in thin slices of a greyish-orange. The odour and taste are camphoraceous.

Chemical composition.—A proximate analysis of this curcuma afforded :—

Essential oil, resin, &c.	4·47
Resins, sugar, &c.	1·21
Gum, organic acids, &c.	10·10
Starch	18·75
Crude fibre	25·20
Ash	7·57
Moisture	9·76
Albuminoids, &c.	22·94
	100·00

Commerce.—The drug comes overland from Bengal. Value, Rs. 4 to Rs. 5 per maund of 41 lbs. Guibourt appears to have become acquainted with it from its admixture with the turmeric of commerce.

Curcuma Amada,—*Roxb., Rosc. Scit. t.* 99, a native of Bengal, is the Am-haldi or Am-ada (mango ginger) of the natives of India. The lateral tubers, which are of the size and shape of ginger, and of a pale yellow colour, have an agreeable odour like the rind of the mango fruit. They are much used in Bengal as an ingredient in *chutneys,* and are considered to be carminative, stomachic, and cooling. In their medicinal properties they resemble ginger. The plant is hardly known in Western India, and is not the Amba-halad or mango turmeric of Bombay, which is *Curcuma aromatica.*

INDIAN ARROWROOT.

Indian or **Curcuma Arrowroot** is obtained from the following plants :—

Curcuma angustifolia, Roxb., a native of the tropical Himalaya and Oudh.

Curcuma leucorhiza, Roxb., a native of Behar. (*Rosc, Scit.*, *t.* 102.)

Curcuma montana, Rosc., a native of the Concan and Circars. (*Roxb. Cor. Pl.*, *t.* 151.)

Curcuma longa, Linn. The Turmeric plant. (*Bentl. & Trim.*, *t.* 269.)

Curcuma aromatica, Salisb., a native of the plains of India. (*Rosc. Scit.*, t. 103.)

Curcuma rubescens, Roxb., a native of Bengal.

Hitchenia caulina, Baker, a native of the Concan. (*Journ. Bomb. Nat. Hist. Soc.*, II., 140.)

Vernacular.—Tikhur (*Hind.*, *Beng.*), Tavakhir (*Mar.*).

History, Uses, &c.—Tavakshiri, and Tavakshiryekapattrika are Sanskrit names for certain species of Curcuma, from which are derived the vernacular terms *Tavakhir* and *Tikhur*, now in common use for Curcuma starch. The starch is prepared in many parts of India by grating or pounding the tubers, mixing the pulp thus obtained with water, straining it through a cloth, and allowing the liquid to stand until the starch separates. This, after several washings in water, is dried in the sun, and after powdering is ready for use.

The following account of the experimental cultivation of *C. angustifolia* and of the preparation of its starch at the Saidapet Experimental Farm, Madras, gives the most exact information we possess regarding the yield and cost of Curcuma Arrowroot:—"A flat measuring 0·25 acre was planted with this crop at the end of 1879, and remained down during the year under report. It was taken up at the end of January 1881 and yielded 986 lbs. of tubers, or at the rate of 3,944 lbs. per acre. The yield of flour obtained has generally been about 12½ lbs. from 100 lbs. of tubers, so that the above yield would represent an outturn of 493 lbs. of flour per acre. In another case in the College Experimental Garden, a plot measuring 1,160 square yards, planted with this crop yielded 1,793 lbs., or at the rate of 7,500 lbs. per acre. The culture of the plant is very simple: it is only necessary to plant the sets in properly prepared soil, and to water them occasionally during the dry season. The removal of the crop is tedious unless the tubers can be ploughed out, as potatoes are in England, which is seldom possible, owing to the dryness of the soil. The flour can be sold profitably at four annas per pound, and at this rate Rs. 400 per acre could be realized."

Mr. Hamilton, F.C.S., to whom samples of the starch were submitted, reported that the mucilage yielded by a sample marked "1st sort" was nearly as good as that of Maranta arrowroot, but that the sample when soaked in cold water gave indications of the presence of slight acidity, and also contained a small proportion of soluble starch. He suggested the avoidance of unnecessary exposure to the sun, and the addition of ½ an ounce per gallon of caustic soda to the water used in steeping the pulped roots. All the samples sent to him contained extraneous matters, black particles, straw, &c., introduced during the process of drying, which, it is hardly necessary to say, would render the article unsaleable in Europe.

Curcuma arrowroot is inferior in colour to Maranta arrowroot; under the microscope it may differ greatly in appearance, as the starch grains of different species of Curcuma are variable in size and shape.

Commerce.—Madras in 1869-70 exported 3,729 cwts. of Curcuma arrowroot, valued at Rs. 14,152. In Bombay "Malabar Arrowroot" fetches from Rs. 3 to Rs. 4 per maund of 28 lbs.

CURCUMA LONGA, *Linn.*

Fig.—*Bentl. and Trim., t.* 269; *Rheede, Hort. Mal. xi., t.* 11. Turmeric (*Eng.*), Curcuma, Souchet des Indes, Safran des Indes (*Fr.*).

Hab.— Parasnath in Behar. Cultivated elsewhere. The tubers.

Vernacular.—Haldi, Haldar, Halja (*Hind.*), Halad (*Beng., Mar., Guz.*), Manjal (*Tam.*), Pasapu (*Tel.*), Mannal, Marinalu (*Mal.*), Arishina (*Can.*).

History, Uses, &c.—Turmeric appears to have come into use in India as a substitute for saffron and other yellow dyes, which were used by the ancient Arians before they invaded the country. The Arians were, as we know, great worshippers of the solar system, hence they held in special estimation those plants which yield a golden-yellow dye resembling sunlight, and attributed to them protective and auspicious properties.

Turmeric, best known as Haridra in Sanskrit, has forty-six synonyms, such as Pita "yellow," Gauri " brilliant," Varnavat "having colour," Kamala "lustful," Nisa, Rajani, and all other words which signify "night." The use of the latter synonyms is variously explained. A distinguished professor of Sanskrit, whom we consulted, referred us to one of the best commentators on the *Amarakośa,* who states that turmeric being a substance used for dyeing came to be called *rajani,* which etymologically means the material by which a thing is dyed, because the word *rajani* had already come to be used in the language to denote " night." A well-known Bombay *Vaid,* to whom we put the question, replied, "We have tradition that it is called 'night,' because in former times married women used daily to apply turmeric in the evening." On further enquiry we learned that this practice is not extinct, as he supposed, but still prevails in Goan villages, about Asnora, and probably elsewhere. Married women in the evening, when the house-work is completed, dip their hands in turmeric water and pass them lightly over their cheeks: the mistress of the house also performs the same office for any married friend who may happen to drop in at this time, and on some pretence detains her until the lamps are lighted. The reason they give for doing this is that the goddess Lakshmi may visit the house at this time. This goddess is regarded as the wife of Surya, and the practice is probably a survival of sun-worship. In Hindu ceremonial turmeric is almost always necessary. Amongst the most important occasions on which it is used we may mention the following as prevailing in most parts of India:—

A few days before the marriage ceremonies commence, five married women, or five virgins, anoint the bride with turmeric and oil upon the forehead, head, breast, back, and feet, and the bride puts on a robe dyed with turmeric, which she wears until the day of the marriage. Turmeric and oil is sent from the house of the bride to the bridegroom, who is anointed in a similar manner, and sends back a similar present to the bride.

The marriage contract is stained or spotted with turmeric. During the ceremonies the sisters of the bridegroom perform *árta* before him with a dish of turmeric water, and, dipping their fingers in it, touch his forehead.

A portion of the wall is daubed with turmeric and dashes of *kunku* after the arrival of the bride in the bridegroom's house, and before it are placed the *kul* and all the clothes and ornaments constituting the marriage presents; the bridegroom, and after him the bride, prostrate themselves before this spot.

The bridegroom ties a thread round the bride's wrist, to which is attached a piece of turmeric and a betelnut.

Towards the end of the ceremonies the bridal party play with turmeric water, dashing it over one another.

A woman who performs *sati* and married women when they die are taken to the funeral pile clothed in a robe dyed with turmeric.

At all times when *púja*, or worship of the gods, is made, turmeric is necessary.

When a new *sári* (robe) has been purchased, two threads are drawn out, one of which is offered to Surya, and the other to the goddess Tulasi, and turmeric is applied to the corner of the cloth.

Turmeric powder and *kunku* (a pigment made with turmeric and lime) is presented to women who have husbands living, and to temple dancing girls, in the month of Chaitra, or upon the occasion of the Nauratra.

The Akshata rice used in various ceremonies is coloured with turmeric and lime.

In the *Ramayan* turmeric is mentioned as one of the eight ingredients of the *Arghya*, a respectful oblation made to gods and venerable men. The following are the lines as given in the Hindi version of that poem:—

Dahi, dúrba, rochan, phal, múla,
Nav tulsi dal, mangal-mula.

Curdled milk, Durva grass,
Yellow gall stones of the cow, Fruit,
Roots, Lotus and Tulsi leaves,
Turmeric.

Medicinally turmeric is described in the Nighantás as hot, bitter, pungent, astringent and drying; it corroborates the humors, prevents skin diseases, is a useful application to swellings, boils, &c., and is given in jaundice. As a domestic remedy it is in daily use; rubbed down with oil it is applied to any roughness of the skin, with lime to bruises, sprains, and all kinds of wounds; a decoction forms a cooling eyewash, boiled with milk and sugar it is the popular remedy for a cold, the fumes are inhaled by those suffering from severe coryza, cloth dyed with turmeric is used as an eye-shade, and *ghi* mixed with powdered turmeric is given to relieve cough. As a spice the powder is an ingredient in curries and sweetmeats, and is used by every native of India. The leaves are also used as a condiment, especially with fish, which is wrapped in them and fried.

It is doubtful whether turmeric was known to the Greeks. Dioscorides mentions an Indian root as a kind of κύπειρος resembling ginger, but having, when chewed, a yellow colour and bitter taste. The Mahometans use turmeric medicinally in the same manner as the Hindus; they also prescribe it in affections of the liver and jaundice on account of its yellow colour. There are many Arabic names; the best known are Urúk-es-sufr "gold root," and Uruk-es-sabághín "dyers' root." The modern Persian name is Zard-chubah "stick saffron." The editor of the *Pharmacopœia of India* speaks favourably of the use of a decoction of turmeric in purulent conjunctivitis; he says it is very effectual in relieving the pain. In coryza he states that the fumes of burning turmeric directed into the nostrils cause a copious mucous discharge, and relieve the congestion. (*Op. cit.* p. 231.)

Cultivation.—Turmeric requires a loamy soil and abundance of manure and water; the ground must be well worked and raised into ridges, 9 or 10 inches high and 18 to 20 broad, with intervening trenches 9 to 10 inches broad. The sets, which consist of small portions of the root, are planted on the tops of the ridges, at about 18 inches to 2 feet apart. One acre requires about 900 such sets, and yields about 2,000 lbs. of the fresh root (*Roxb.*). Other authorities state the yield at from 1,000 to 2,000 lbs. Dalzell and Gibson give very much higher figures for the best garden soil in Guzerat, *viz.*, 5,000 to 20,000 lbs. per acre. They state that the return to the cultivator is equal to that obtained from sugar-cane, *viz.*, Rs. 300 per acre. The time for planting is usually about the end of May, but it depends greatly upon the setting in of the rainy season. The crop may be raised in the following March or April; if left in the ground new shoots appear upon setting in of the following rains and the crop is lifted about 20 to 21 months after planting. In some parts of India it is not considered good practice to lift the plants the first year. When lifted, the roots have to be scalded in boiling water or by steaming them in their own juice, and to be dried in the sun or in an oven. Turmeric being much cultivated along with other crops it is impossible to obtain any reliable acreage returns.

Description.—The rhizome of the turmeric plant, like that of most Curcumas, consists of a central ovoid portion and several lateral elongated portions, all of a deep orange colour, from these proceed a number of radicles, at the ends of some of which colourless oval tubers are produced. The central and lateral rhizomes form the round and long turmeric of commerce. The former vary a good deal in size and shape; they may be pyriform, ovoid, or almost round, and are generally cut up into two or more pieces; the latter are cylindrical, tapering towards the extremities, and often more or less bent; both are marked by transverse furrows, and bear remains of the rootlets and leaf-buds. Turmeric is of a deep brownish-yellow colour, of firm resinous consistence, and has a peculiar aromatic odour.

Microscopic structure.—Sections of the fresh rhizome show the exterior to be composed of several layers of compressed brown cells. The parenchyme consists of delicate polygonal cells of a yellow colour, the majority contain starch grains which are mostly elongated, but some are pyriform or ovoid; a smaller number of cells contain globular masses of yellow resinous matter, and a rich orange-yellow essential oil; those cells which contain much resin have little or no oil, when the resin is in small quantity there is much oil. The vascular system consists of scalariform and spiral vessels, which are most abundant near the boundary line which separates the cortical from the central portion of the rhizome. This boundary line is composed of small empty cells, having thicker walls than those of the rest of the parenchyme.

Chemical composition.—Turmeric contains about 1 per cent. of an essential oil. *Curcumin*, the yellow-colouring matter of turmeric, has been examined by several chemists, whose experiments have led to the conclusion that its formula is either $C^{10}H^{10}O^{3}$ or $C^{16}H^{16}O^{4}$ that it melts at 172°, forms red-brown salts with alkalies, is converted by boric or sulphuric acid into *rosocyanine*, by reduction with zinc-dust into an oily body, by oxidation into oxalic or terephthalic acid, and by fusion with potash into protocatechuic acid. The experiments of Jackson and Menke have, however, led to results differing in many respect from those above detailed, which were probably obtained from impure preparations.

The Curcumin used in their experiments was prepared by treating ground turmeric root (Bengal or Madras) with light petroleum to remove turmeric oil, and then with ether, which dissolves the curcumin together with a large quantity of resin; and it was finally purified by crystallization from alcohol. The quantity of curcumin thus obtained was only 0·3 per cent. of the root; the total quantity contained in the root is, however, much larger, as a considerable amount remains mixed with the resinous impurities, and some also in the oil. Curcumin thus prepared crystallizes from alcohol in stout needles, appearing on microscopic examination to be made up of well-formed prisms with square ends, or in spindle-shaped crystals often arranged in radiate groups. It has an orange to yellow colour, according to the size of the crystals, with a beautiful blue reflex; its solution in ether exhibits a strong green fluorescence. It is inodorous when pure; melts at 178°, apparently with decomposition. It is nearly insoluble in water, somewhat soluble in cold, more readily in hot ethyl and methyl alcohols, more soluble in glacial acetic acid, less in ether, very slightly in benzene and carbon bisulphide, and all but insoluble in light petroleum. Strong sulphuric acid dissolves it with a fine reddish purple colour, gradually changing to black from charring; curcumin dissolves readily in alkalies and alkaline carbonates. Its ammoniacal solution gives off ammonia when boiled, and deposits unaltered curcumin. Baryta water converts it into a blackish-red powder, but lime water gives a red solution like that obtained with calcium carbonate. Curcumin is not affected by acid sodium sulphite. Pure curcumin gives, as the mean of several analyses, 68·30 per cent. carbon and 5·63 hydrogen, leading to the formula $C^{14}H^{14}O^{4}$, which requires 68·29 carbon, 5·69 hydrogen, and 26·02 oxygen, and this formula has been confirmed by the analysis of several derivatives. For an account of the derivatives of curcumin, confer. *Phar. Journ.*, Dec. 30th, 1882.

Turmeric oil or *Turmerol*, to which turmeric (and therefore curry powder) owes its aromatic taste and smell, has been extracted from Bengal turmeric by C. L. Jackson and A. E. Menke with light petroleum, and after being freed from the higher-boiling portion of that solvent by heating to 150° in a flask, it formed a thickish oily yellow liquid having a pleasant aromatic odour. It was purified by fractional distillation under diminished pressure, and was thereby separated into three portions, the first boiling below 193°, the second at 193° to 198°, and the third consisting of a viscous semi-solid residue. The middle portion consisted of nearly pure turmerol; the first of that substance contaminated with hydrocarbons from the petroleum. The middle fraction, after further purification by distillation in a vacuum, gave, as a mean result of several analyses, 83·62 per cent. carbon and 10·42 hydrogen, agreeing nearly with the formula $C^{19} H^{28} O$, which requires 83·81 C. and 10·29 H. Turmerol is a pale yellow oil having a pleasant aromatic smell, and a density of 0·9016 at 17°. It is optically dextrogyrate, [a]=33·52. Under ordinary pressure it boils at 285° to 290°, but decomposes at the same time, yielding a substance of lower boiling point. (*Amer. Chem. Journ.*, IV., pp. 368-374.) Schimmel and Co. (*Bericht, Oct.* 1890) state that during a scientific investigation of Curcuma oil they proved it to contain *Phellandrene.*

Commerce.—The bulk of the turmeric cultivated in India is consumed in the East as a dye and condiment, and the consumption must be very large as every one uses it. Full particulars cannot be learned, but a trans-frontier trade exists, and the various Indian ports exchanged in 1886-87, 281,117 cwts., valued at Rs. 24,38,260. During 5 years from 1884 to 1888 Tuticorin exported 6,802 cwts. of turmeric at the average valuation of Rs. 7-8 per cwt. In the foreign trade turmeric is treated as a dye, and the statistics include the wild or Cochin kind. In 1885-86 the exports were 156,287 cwts., valued at Rs. 14,00,000; in 1886-87, 140,994, cwts. were exported, valued at Rs. 10,32,025. The trade fluctuates greatly: in 1881-82 only 70,783 cwts. were exported; in 1876-77, 123,824 cwts.

KÆMPFERIA GALANGA, *Linn.*

Fig.—*Rosc. Scit., t.* 92; *Wight Ic., t.* 899; *Rheede, Hort. Mal. xi., t.* 41.

Hab.—In the plains throughout British India. The tubers.

Vernacular.—Chandra-múla (*Hind.*), Chandú-múla, Húmúla (*Beng.*), Kachula-kalangu (*Mal., Tam.*), Chandra-múla, Utuen (*Mar.*), Kapúr-kachri (*Guz.*).

History, Uses, &c.—The plant is called Chandra-múla or Chandra-mulika in Sanskrit, but it is not mentioned in the

Raja-nirghanta. It is much cultivated in gardens by the Hindus, whose women use the aromatic leaves and roots as a perfume when washing their hair; on this account the vernacular names *Utnen* and *Kapur-kachri* have been given to it in Western India, as its odour exactly resembles that of the root of *Hedychium spicatum,* which is sold in the bazars as a *Kapur-kachri,* and is an ingredient in the *Utnen* or perfumed powder for the hair, which has been described in Vol. ii., p. 234. Rheede states that the tubers reduced to powder and mixed with honey are given in coughs and pectoral affections, boiled in oil they are applied externally to remove obstructions in the nasal passages. In the *Dict. Econ. Prod. of India* (IV, 561), it is stated on the authority of Mason that the roots are often seen attached to the necklaces of Karen women, for the sake of their perfume, and that they also place them in their clothes for the same reason. They are also said to be used as a masticatory along with betel leaves and areca nut.

Description.—The roots consist of branched tubers, resembling ginger in form, which give off fleshy fibres bearing white pendulous tubers; they have a peculiarly agreeable camphoraceous odour, exactly like that of the Kapur-kachri of the bazars. The leaves are radical, petioled, ovate-cordate, between acute and obtuse; margins membranaceous and waved; upper surface smooth, deep green; under surface pale and somewhat woolly. The leaves are much crowded, but when they can find room they spread flat on the surface of the earth, the petioles are hid beneath the soil and form cylindric sheaths enclosing the fascicles of flowers, which are of a pellucid white, or white marked with purple spots, and have the same fragrant odour as the leaves and roots. All parts of the plant have a bitterish and camphoraceous taste.

The roots are not met with in commerce, but, judging from some which we have sliced and dried, would appear to be capable of supplying an article equal to the *Kapur-kachri* of the shops. (See *Hedychium spicatum*). The plant is cultivated with the greatest ease, and yields a large crop of roots.

Chemical composition.—The fatty matters dissolved out of this tuber by ether consisted of a fragrant liquid oil, and a solid white crystalline substance separated by petroleum ether. The alcoholic extract, amounting to 2·76 per cent., contained some white transparent prisms of an alkaline nitrate, and a few nodules of a circular-shaped crystals of a yellowish colour. This extract contained a small quantity or alkaloid, and some sweet body reducing Fehling's solution. A large quantity of starch is present, and 4·14 per cent. of gum. The tubers dried at 100°C lost 4·11 per cent. of moisture, and yielded 13·73 per cent. of mineral matter.

KÆMPFERIA ROTUNDA, *Linn.*

Fig.—*Rosc. Scit.*, *t.* 97; *Bot. Mag.*, *t.* 920 and 6054; *Wight Ic.*, *t.* 2029; *Rheede, Hort. Mal.* xi., *t.* 9.

Hab.—Throughout India, often cultivated.

Vernacular.—Bhume-champa (*Hind.*), Bhin-champa (*Beng.*), Bhin-champo (*Guz.*), Bhin-chapha (*Mar.*), Konda-kalava (*Tel.*), Malan-kua (*Mal.*)

History, Uses, &c.—This plant, called in Sanskrit Bhumi-champaka, "ground champaka," from the sweetness of its flowers resembling that of the champaka (*Michelia*), though not mentioned in the Raja-nirghanta, is one of the commonest domestic remedies of the Hindus. Its small globular pendulous tubers, at one time supposed to be the "round zedoary" of the druggists, are used throughout India as a local application to tumours, wounds, and swellings of all kinds. Rheede states that in Malabar the whole plant, when reduced to powder, and used in the form of an ointment, is considered to be of wonderful efficacy in healing fresh wounds, and that, taken internally, it is thought to remove any coagulated blood or purulent matter that may be within the body; he adds that the root is a useful application to anasarcous swellings. In Western India the tubers are used as a popular local application in mumps* (*Gal-*

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* Tuberous roots were used by the ancients for the same purpose. Cf. Scrib. Larg. Comp. 44.

gand), but as they are generally combined with more active remedies, such as Croton seeds, Aconite, and Nux Vomica, it is probable that they do not contribute much to the cure. The root consists of several central, almost globular rhizomes, from which proceed numerous, thick, fleshy rootlets, all of which terminate in small, oblong, or round tubers; the substance of the rhizomes and tubers is of a pale straw colour, and has a bitter, pungent, camphoraceous taste, much like that of true zedoary; the whole plant is aromatic.

HEDYCHIUM SPICATUM, *Ham.*

Fig.—*Bot. Mag.*, *t.* 2300.

Hab.—China Himalaya. The tubers.

Vernacular.—Kápúr-kachri, Kachúr-kacha, Kachri (*Hind.*), Kápúr-kachari (*Mar.*, *Guz.*), Shimai-kichilik-kizhangu (*Tam.*).

History, Uses, &c.—Sati, the Sanskrit name for *Curcuma Zedoaria*, is sometimes erroneously applied to this plant, which is not mentioned in the *Raja Nirghanta*. In the Himalayas it is known as *Sheduri*, and the leaves are made into mats which are used as sleeping mats by the hill people. The aromatic root-stocks are used as a perfume along with Henna (*Lawsonia alba*) in preparing the cloth known in the North-West Provinces as Malagiri (*Watt*). The sliced and dried root is an article of considerable importance in Indian trade, as it is a principal ingredient in the three kinds of *Abîr*, or scented powder, used by the Hindus in worship, and as a perfume. White Abír is made from the following ingredients:—The root of *Andropogon muricatus*, the tubers of *Hedychium spicatum*, sandalwood and arrowroot (Indian), or flour of Sorghum. The kind of Abír called *Ghísi* in Hindí, and *Padí* in Guzeráthí, contains in addition to the above ingredients the seeds of *Prunus Mahalib*, *Artemisia Sieversiana*, the wood of *Cedrus Deodara*, the tuber of *Curcuma Zedoaria*, cloves and cardamoms. Black Abír, or *Bukka* of the Deccan, contains in addition to all the above ingredients, Aloeswood, costus, the root of *Nardostachys Jatamansi*, and liquid Storax. The scented powder of the Jains called *Vásakhepa* or

Vásakshepa, does not contain it, but consists of sandalwood, saffron, musk, and Borneo camphor. Two kinds of Kápúr-kachrí are found in the Bombay market, *viz.*, Chinese and Indian; the latter was supposed by Royle to be the *Sittarittee* or lesser Galangal of Ainslie (*Mat. Ind.* I., p. 140), but Moidín Sheriff states that the Sittarittee of the Tamils is the true lesser Galangal, which statement appears to be correct. Powell informs us that the rhizome is pounded with tobacco and smoked in the Punjab.

Description.—Indian Kápúr-kachrí occurs in slices, mostly circular, but sometimes the section is made in a sloping direction; the slices are ½ an inch or less in diameter, and vary much in thickness; they are white and starchy, and when freshly pared exhibit a faint line dividing the cortical from the central portion; the edges of each slice are covered by a rough reddish-brown bark marked with numerous scars and circular rings; here and there rootlets remain attached; the odour is like that of orris root, but more powerful and strongly camphoraceous; the taste pungent, bitter, and aromatic. The Chinese drug is a little larger than the Indian, whiter, and less pungent; the bark is smoother and of a lighter colour.

Microscopic structure.—The rhizome consists of a delicate parenchyma, most of the cells of which are loaded with large ovoid starch grains, a few contain a yellowish resin, and essential oil; the epidermis is composed of several rows of compressed, nearly empty, reddish-brown cells. From the unaltered condition of the starch it appears that the rhizomes are not exposed to heat.

Chemical composition.—The dried tubers have been examined by J. C. Thresh (*Pharm. Journ.* [3] XV, 361). The proximate analysis gave the following results:—

Soluble in petroleum ether—		
Ethylmethylparacoumarate	3·0	5·9
Fixed oil and odorous body	2·9	
Soluble in alcohol—		
Indif. substance ppt. by tannin		2·7
Acid resin, &c.		

Soluble in water—

Glucoside or saccharine matter	1·0
Mucilage	2·8
Albuminoids, organic acid, &c	1·9
Starch	52·3
Moisture	13·6
Ash	4·6
Cellulose, &c.	15·2
	100·0

The odorous principle was entirely taken up by petroleum ether, upon allowing the petroleum ether to evaporate slowly, an abundant crop of large, colourless, tabular crystals was obtained, together with a pale yellowish-brown oily fluid. These crystals, after washing with cold petroleum, were submitted to a series of recrystallizations in order to remove traces of the odorous matter. They were finally obtained quite odourless, and found to possess the following properties:—Soluble in petroleum ether, ether, alcohol, chloroform and benzol. Insoluble in diluted solutions of potash, soda or ammonia. Sulphuric acid dissolved it in the cold without production of colour, but if heated the solution became purple red. The alcoholic solution was neutral in reaction, not coloured by ferric chloride or precipitated by basic lead acetate. It did not reduce silver salts.

The melting point (uncorrected) was found to be 120—121° F. (49° C.), and after melting it would remain fluid at ordinary temperatures for days if left undisturbed.

By burning with copper oxide in a current of oxygen the following results were obtained:—

·2931 gram yielded ·7490 gram CO^2 and ·1804 gram H^2O.

·2703 gram gave ·6912 gram CO^2 and ·1690 gram H^2O.

These results agree with the empirical formula $C^{12}H^{14}O^{3}$:—

The uncrystallizable portion of the petroleum ether residue was found to consist of the odorous principle, a fixed oil and a very considerable proportion of ethylmethylparacoumarate, the latter doubtless prevented from crystallizing by the presence of the former. Upon saponification of the mixture with alcoholic potash, two crystalline acids were obtained, the *methyl-paracoumaric* and another, apparently a fatty acid. This latter was totally insoluble in boiling water, but crystallizable from alcohol. The quantity obtained did not enable the author to identify it with certainty. A minute quantity of the oily fluid abovementioned dropped upon the clothes, rendered them highly odorous for a considerable length of time, or, if exposed caused a large room to be pervaded with an odour resembling that of hyacinths.

Commerce.—The Chinese drug which forms by far the greater proportion of the commercial article is shipped to Indian ports *viâ* Singapore, and is valued at Rs. 4⅓ per maund of 37½ lbs. Sir E. Buck (*Dyes and Tans of the N.-W. Provinces*) gives the export from Kumaon in 1875-76 as 95⅙ cwts., and also states that in the same year an equal quantity was exported from Garhwal, and 40½ cwts. from the Bijnor district. In Davies' *Trade Report* 25 maunds (about 2,000 lbs.) are given as the annual export *viâ* Peshawar to Afghanistan (*Dict. Econ. Prod. Ind.* IV., p. 208). The Indian kind is valued in Bombay at about Rs. 5 per maund of 37½ lbs. It is not so handsome in appearance as the Chinese, but is more odorous.

ZINGIBER OFFICINALE, *Rosc.*

Fig.—*Bentl. and Trim., t.* 270; *Rosc. Monand. Pl.*, 83; *Woodville, t.* 250; *Steph.* and *Ch., t.* 96.

Hab.—Cultivated throughout the East. The rhizome.

Vernacular.—(Fresh) adrak, adi, (dry) Sonth (*Hind.*); (fresh) Alen, (dry) Sonth (*Mar.*); (fresh) Ada, (dry) Sont (*Beng.*); (fresh) Inji, (dry) Shukku (*Tam.*); (fresh) Allam, (dry) Sonti (*Tel.*); (fresh) Hasisunthi, (dry) Vana-sunthi (*Can.*); (fresh) Adu, (dry) Sunth (*Guz.*); (fresh) Inchi, (dry) chukka (*Mal.*).

History, Uses, &c.—Ginger has been cultivated in India from prehistoric times; it is a native of the East, but is not now known in a wild state. In Sanskrit it bears many names, such as Mahaushadha "great remedy," Visva "pervader," Visva-bheshaja "panacea," Sringavera "antlered," Katubadra "the good acrid," &c. When dried it is known as Sunthi and Nágara in distinction from Ardraka "fresh ginger." In the Nighantás it is described as acrid and digestive, useful for the removal of cold humors, costiveness, nausea, asthma, cough, colic, palpitation of the heart, tympanitis, swellings, piles, &c. Ginger is one of the three acrids (trikatu) of the Hindu physicians, the other two being black pepper and long pepper; combined with other spices and sugar, as in the preparations known as *Samasarkara churna* and *Saubhagya sunthi*, it is given in dyspepsia and loss of appetite. In rheumatism preparations of ginger and other spices with butter are given internally, and it is an ingredient in oils used for external application. The juice of the fresh tubers, with or without the juice of garlic, mixed with honey, is a favourite domestic remedy for cough and asthma, with lime juice it is used in bilious dyspepsia, and a paste of dry ginger and warm water is applied to the forehead to relieve headache. In Western India, ginger juice, with a little honey and a pinch of burnt peacock's feathers, is the popular remedy for vomiting. In old Persian we find the names *Shingabir* or *Shangabir* and *Adrak* applied to ginger, and it was probably through the Persians that the Greeks first became acquainted with it, as their ζιγγίβερι is evidently derived from the Sanskrit *Sringavera* through the Persian form of the word. The Arabic name *Zanjabil* is of similar origin, the chief difference being the substitution of the letter J for G, which is not in the Arabian alphabet.

Ginger is described by Dioscorides as hot, digestive, gently laxative, stomachic and having all the properties of pepper; it was an ingredient in collyria and antidotes to poison. Pliny notices it in his chapter on peppers, but very briefly, and it does not appear to have been regarded as an article of much importance in his time.

In the second century of our era, ginger is mentioned as liable to duty (vectigal) at Alexandria along with other Indian spices.

(*Vincent Com. and Nav. of the Ancients*, III, 695). Galen recommends it in paralysis and all complaints arising from cold humors; Paulus in neuralgia and gout. Ibn Sina and other Arabian and Persian physicians closely follow the Greeks, but enlarge upon its aphrodisiacal properties. In modern medicine the value of ginger as a carminative in atonic dyspepsia and flatulent colic, and as a masticatory in relaxed conditions of the throat is generally admitted.

The manufacture of ginger beer and ginger ale forms a large portion of the mineral water trade in England; indeed, some makers have acquired a special reputation for their production. Besides the large number of fermented and aërated ginger beers consumed at home, a good deal of ginger ale is shipped in glass bottles from Belfast, especially to the United States. About 16,000 packages or casks are so exported annually, for it has become a fashionable beverage in America among all classes.

According to the American official returns the imports in the two years ending June were as follows (the duty being 20 per cent.):—

	1888. Dozen bottles.	1889. Dozen bottles.
Ginger ale and beer......	231,721	261, 828
Ginger cordial..................		262
Preserved ginger (35 per cent. duty) value......	$14,289	$2,670
	Hundredweights.	Hundredweights.
Raw ginger (duty free)	34,194	27,718

The value of the ginger ale and beer imported there was in 1887, $153,376 ; in 1888, $126,987, and in 1889, $92,001.

The manufacture of ginger ale seems to have been commenced there also; for last year 3,512 dozen quarts were sent away from New York and New Orleans, besides what was locally consumed.

The number of uses to which ginger is applied besides as a spice, confection and medicine are many ; for instance, we have gingerade, ginger ale, ginger beer, ginger brandy, ginger bread, ginger champagne, ginger cordial, ginger essence, ginger lozenges and ginger wine.

On the Continent of Europe, ginger is less used and appreciated than in England.

Soluble essences of ginger are required for making good ginger beer, and Belfast and American ginger ales. There are aërated and fermented ginger beers; the best unbleached Jamaica ginger, well bruised, being used for the latter. Ginger is also used for a kind of cordial and champagne.

Lastly, young ginger is candied and preserved to a considerable extent in the East, and comes into commerce under the section of "succades." The quantity imported into England from India and China ranges from 300,000 to 600,000 pounds, of the value of £11,000 to £25,000. The mode of preserving it is to steep the rhizomes in vats of water for several days, changing the water once. When taken out it is spread on tables and well pricked or pierced with bodkins. The rhizomes are then boiled in a copper caldron, then steeped for two days and nights in a vat with a mixture of water and rice flour. After this they are washed with a solution of lime, then boiled with an equal weight of sugar and a little white of egg is added to clarify.

After the ginger has been boiled a second time it is put in glazed jars of pottery, holding 1 pound, 3 pounds or 6 pounds, and covered with syrup. The syrup is changed two or three times, and then they are shipped in cases holding six jars.

The quality called "Mandarin" is put up in barrels. (*P. L. Simmonds, Amer. Jn. Pharm.* 1891.)

Description.—Many qualities of ginger are met with in Eastern commerce, which vary greatly in appearance; the fresh tubers also vary in size, flavour and colour in different soils. One variety found in gardens in the Concan has a darker colour than ordinary ginger and somewhat of a zedoary flavour; it is known as *Kala-Ala,* "black ginger." Dried ginger is known in two forms, namely, the rhizome with its epidermis, in which case it is called *coated*; or deprived of epidermis, and then termed *scraped* or uncoated. The pieces, which are called by the spice dealers *races* or *hands*, rarely exceed 4 inches in length and have a somewhat palmate form, being made up of a series of short, laterally compressed, lobe-like shoots or knobs. Uncoated Cochin ginger, which is the best kind produced in India, has a pale buff hue, and a striated, somewhat fibrous, surface. It breaks easily, exhibiting a short and farinaceous fracture with numerous bristle-like fibres and closely resembles Jamaica ginger in appearance and flavour. "Black" Cochin ginger is that dried in the wet weather by means of hot ashes. Bengal and Bombay gingers have a brownish or reddish external surface, and the fractured surface is harder and darker, the flavour is less delicate than that of the Cochin sort. Coated gingers are now seldom met with, but Indian commercial samples usually contain a proportion of shrivelled and imperfectly scraped roots.

Chemical composition.—Ginger has been very completely examined by J. C. Thresh. (*Pharm. Journ.* (3) xii., 721). He found Cochin ginger to contain volatile oil 1·350; fat, wax (?) and resin (in the petroleum ether solution), 1·205; neutral resin ·950; *a.* and *b.* resins, ·865; *Gingerol*, ·600; substance precipitated by acids, 5·350; mucilage, 1·450; indifferent substance precipitated by tannin, organic acids, &c., 6·800; extractive soluble in alcohol not in ether or water, ·280; alkaloid a trace; metarabin, 8·120; starch, 15·790; pararabin, 14·400; oxalic acid (as CaC^2O^4), ·427; cellulose, 3·750; albuminoids, 5·570; vasculose, &c., 14·763; moisture, 13·530; ash, 4·800. The essential oil is pale-yellow, lævogyre and not acrid. Gingerol, the active principle, is a straw-coloured, viscid, odourless fluid of extremely pungent taste.

According to S. J. Riegel, East India ginger yields 8 per cent. of oleo-resin, whereas Jamaica ginger only yields 5 per cent. It may be best extracted by alcohol, ether or chloroform, benzin will dissolve it, but it does not exhaust the drug as satisfactorily as the other solvents.

Commerce.—Ginger is extensively cultivated in British India, from the Himalayas to Cape Comorin.

In the Himalayas it is successfully reared at elevations of 4,000 or 5,000 feet, requiring, however, a moist soil. The Malabar ginger, exported from Calicut, is the produce of the district of Shernaad, situated to the south of Calicut. In the Dacca district the natives cleanse the roots in boiling lime water, which probably injures much of the fragrant pungency, whereas in Jamaica they use simply plain water.

In order to dry ginger into what is called "sonth" in India—that is, to enable it to keep—the fresh roots are put into a basket, which is suspended by a rope, and then two men, one on each side, pull it to and fro between them by a cord attached, and thus shake the roots in the basket; this process is carried on for two hours every day for three days. After this the roots are dried in the sun for eight days, and again shaken in the basket; the object of the shaking being to take off the outer scales and skin of the roots. Two days further drying completes the process, and the ginger sells at about a rupee, or two, for 6 or 8 pounds. The value of the East Indian ginger exported went on increasing from about £63,000 (44,457 hundredweights) in 1881 to over £199,000 (133,280 hundredweights) in 1887; but in the last three years it has retrograded, having fallen to £70,398 (61,774 hundredweights) in the financial year ending March, 1890.

Last year, of 63,500 cwts. imported into England, India sent 53,500 cwts., Jamaica, 5,900 cwts., and West Africa, 2,600 cwts. *(P. L. Simmonds.)*

ZINGIBER CASSUMUNAR, *Roxb.*

Fig.—*Roxb. in As. Research.* 11, *t.* 7; *Bot. Mag., t.* 1426; *Rox. Monand. Pl.*

Hab.—India. The rhizomes.

Vernacular.--Ban-ada (*Beng.*), Nisa, Malabari-halad (*Mar.*), Karpushpu (*Tel.*), Ban-adrak, Ban-adi (*Hind.*).

History, Uses, &c.—This plant, in Sanskrit Vaárn-draka or "wild ginger," though not mentioned in the Rája Nirghanta, appears to be well known in most parts of India as a domestic remedy among the peasantry, who rub down the tubers with water for administration in diarrhœa and colic. Though Roxburgh has named this plant *Cassumunar*, it appears to be very doubtful whether its roots have ever been exported to Europe or have ever been an article of commerce in India. *Kattu-mannal* is a Malabar name for the yellow zedoary, and it appears to be this plant which has furnished the Cassumunar root of the druggists (cf. *Pereira, Mat. Med.*, ii., Pt. 1, p. 236). In odour and taste both roots are very similar. The Marathi name Nisa is Sanskrit and signifies "turmeric," and seems to indicate that the tubers of this plant are used as a substitute for that article by the peasantry.

Description.— The fresh rhizomes are 1 to 2 inches in diameter, jointed, compressed, with numerous white fleshy radicles, to some of which white tubers are attached. Each joint of the rhizome is furnished with a leaf bud. The epidermis is scaly, light-brown, the interior of a rich golden yellow, the odour is powerful and not very pleasant, like a mixture of ginger, camphor, and turmeric; the taste hot and camphoraceous.

Microscopic structure.— The epidermis is formed of many layers of compressed and obliterated cells. The parenchyma consists of large polyhedral cells; those in the cortical portion of the rhizome are nearly free from starch, but those in the central portion are filled with large ovoid starch granules. In all parts of the rhizome large cells full of a golden-yellow essential oil abound. The vascular system resembles that of turmeric.

Chemical composition.—The drug yielded to analysis:—

Ether extract (essential oil, fat, and soft resins) ...	6·96
Alcoholic extract (sugar, resins)	7·29
Water extract (gum, acids, &c.)......................	13·42
Starch	15·08
Crude fibre	12·61
Ash	6·80
Moisture	7·66
Albuminoids, modifications of arabin, &c.	30·18
	100·00

The root had a pungent odour, similar to a mixture of camphor and nutmeg, the soft resin had a bitter and burning taste. The colouring matter had many of the reactions of curcumin, but was more readily bleached than true curcumin, and the colour of the powder was very fugitive. The water extract gave a crystalline precipitate with lead acetate, which was found to be due to the presence of malic acid. The root contained more mucilage and sugar than that of *Curcuma aromatica.* We were unable to separate any of the "soapy extractive" mentioned in the analysis of Cassumunar root by Luca.

Costus speciosus, *Sm., Lam. Ill. i., t.* 3; *Rheede, Hort. Mal. xi., t.* 8.

Vernacular.—Keú (*Hind.* and *Beng.*), Peṅva पेँवा (*Mar.*), Kemuka (*Sans.*). Roxburgh notices a preserve made of the fresh roots which is considered wholesome and nutritious. *C. speciosus* is the *Tjana-kua* of Rheede and the *Herba spiralis hirsuta* of Rumphius. Ainslie, quoting Brown's History of Jamaica, says that the root is there used as a substitute for ginger, but is very inferior to it. (*Mat. Ind.* ii., 167.) In the *Calcutta Exhibition Catalogue,* the root is described as depurative and aphrodisiac; similar properties are attributed to it in the Concan, where it is very abundant in moist situations. The rhizome resembles the great Galangal in growth and structure, but has no aromatic properties, the taste being mucilaginous and feebly astringent; it could only be used as a substitute for ginger by being preserved with a quantity of that root sufficient to flavour it.

ELETTARIA CARDAMOMUM, *Maton.*

Fig.—*Rheede, Hort. Mal. xi., tt.* 4 and 5; *Bentl. and Trim., t.* 267; *Woodville, t.* 231; *Roxb. Cor. Pl. iii., t.* 226. Malabar Cardamom (*Eng.*), Cardamome du Malabar (*Fr.*).

Hab.—West and South India. The fruit.

Vernacular.—Chhoti-iláyachi or iláchi (*Hind.*), Elaich, Gujrati-elaich (*Beng.*), Elchi (*Guz.*), Veldoda (*Mar.*), Ella-kai (*Tam.*), Yálakki (*Can.*), Elettari (*Mal.*), Elakaya, Vittula (*Tel.*).

History, Uses, &c.—The small cardamom, in Sanskrit Ela, is mentioned by Susruta. In the Nighantas it bears various synonyms, such as Truti, Kapota-varni "grey," Korangi, and Dravidi "coming from the Dravidian country." The large or Nepal cardamom (*Amomum subulatum*) is called Sthulaila "large Ela," and is described separately. Both kinds are considered to be digestive, pungent, light and hot, and are recommended in phlegmatic affections, such as cough, asthma, piles, and diseases of the bladder and kidneys. These two cardamoms are described by Ibn Sina under the name of قاقله (kakulah); he also describes separately under the name of هیل بوا (hilbawa) another kind of cardamom as more easily digested than the *kakulah*. This latter cardamom is the true *Cardamomum majus* or *Nutmeg cardamom* of Africa to which Pereira has given the name of *Amomum korarima*. We think that there can be no doubt that the Greeks were acquainted with the cardamoms of India which they appear to have first obtained from the Persians through Syria and Armenia. Dioscorides says:—"Choose that which is tough, well filled, closed; if not in this state, it is too old and has lost its aroma. The taste is pungent and somewhat bitter." With respect to the name Kátídáús, the Greeks appear to have applied it to this spice in much the same way as the Persians applied the name kakulah, which originally meant the fruit of some other plant which was used for flavouring bread. In the *Burhán* it is stated that the name *kakulah* is also given by some to a fruit like *sapandan* (a kind of cress), which is the same as *Ilachi*.

Besides the two Indian cardamoms, there is a large kind of cardamom which comes from Ceylon, now found in commerce. Dr. Trimen, in his *Systematic Catalogue of the Flowering Plants and Ferns of Ceylon,* speaks of the plant which produces it as *Elettaria cardamomum,* Maton, *var. major*—the *Ensál* of the Singhalese.

As a masticatory and for flavouring food, the Malabar or small cardamom is preferred by the natives, but the other kinds, which are cheaper and of less delicate flavour, are largely used by the sweetmeat makers.

Cultivation.—There are two ways of propagating the plant, viz., by sets or by seed. The chief requirements for successful cultivation are a rich loamy soil, and a site sheltered from strong winds and too much direct sunlight. Clearings in forest land, with a few trees left here and there, in order to give the requisite shade and shelter, are found to offer the best conditions for the production of good crops. In the planting of sets, young ones of one to two years old should be chosen. Holes one foot deep and 18 inches wide are dug, and into these, after they have been prepared as beds, raised a few inches above the surrounding ground, the sets are inserted just below the surface of the soil.

The spaces between each plant may be from 6 to 12 feet, according to the quality of the soil. The ground should be well cleared of weeds, stones and rubbish, but when the plants have grown to a certain size, no further weeding will be necessary, as nothing will grow under their shade. Seeds should be sown in prepared nurseries, care being taken not to sow too deep. The seedlings, when 6 to 8 inches in height, should be transplanted and treated in the same manner as sets. (*Dict. Econ. Prod. Ind.* iii., p. 229). For the particulars of cardamom cultivation in the Wynaad, Travancore, Mysore, Madura, Coorg, and Canara, the same work may be consulted. To prepare cardamoms for the market, they are washed, bleached, and starched. For washing, 2 lbs. of pounded soapnuts and ¼ lb. of *Acacia concinna* pods are mixed with about

5 gallons of water, and a separate solution of common country soap is made. Three quarts of the soapnut mixture are added to 8 quarts of water, and in this 10 lbs. of cardamoms are well agitated by hand and then transferred to a basket to drain for a few minutes. They are then washed a second time in 7 quarts of water, one of the soapnut mixture, and one of the soap solution, drained and thrown upon a mat. Then they are continually sprinkled with fresh water by relays of women until sunrise next morning, when they are spread out on mats to dry for four or five hours. The stalks are then cut off with scissors, at which work some women are so expert as to be able to nip 90 cardamoms in one minute. This done, the cardamoms are sorted for export. The starching process, which has only lately been introduced, consists in sprinkling the cardamoms with a thin paste made of rice and wheat flour, country soap, and butter milk, and rubbing them between the palms of the hands.

The washing mixtures are used for two lots of cardamoms and are then thrown away. The women who wash are paid 3 annas per diem; the night watchers 4 annas, and the nippers 2½ annas per 13 lbs.

Description.—The cardamom of commerce is a dry, three-sided, oblong, or roundish capsule of a yellowish-brown or dirty white colour. The pericarp is tough, and divides into three valves, from the middle of the inner surface of each a partition projects towards the axis, so as to divide the capsule into three cells, each of which is filled with closely packed angular seeds, each surrounded by a thin transparent membrane (aril). The seeds are of a rich brown colour, about two lines long, transversely rugose, with a depressed hilum, and deeply channelled raphé. The capsule is almost tasteless. The seeds have a pungent, camphoraceous, agreeable flavour, and leave a sensation of cold upon the tongue when chewed.

Microscopic structure.—The testa of the seed is formed of three layers: 1*st*, a layer of thick-walled striated cells; 2*nd*, a layer of large thin-walled cells; 3*rd*, an internal layer of dark-brown radiating cells, with very thick walls. The albumen is colourless and consists of polyhedral cells containing starch, and generally rhomboidal masses of albuminous matter, which can be easily seen when thin slices of the albumen in almond oil are examined by polarized light.

Chemical composition.—The parenchyme of the albumen and embryo is loaded with fatty oil and essential oil, the former existing in the seed to the extent of about 10 per cent. The essential oil, which amounts on an average to 4·6 per cent., has the odour and flavour of the seeds; it consists chiefly of a liquid having the formula $C^{10} H^{22} O^{3}$. According to Flückiger, the raw oil is dextrogyre, and deposits after a time a camphor, which he considers to be identical with common camphor, as it agrees with that substance in optical properties and crystalline form. The water which comes over when cardamoms are distilled, contains acetic acid. The ash of cardamoms, which, according to Warnecke, amounts to 6·12 per cent. in common with that of several other plants of the same order, is remarkably rich in manganese.

Commerce.—The trade in Indian cardamoms seems to have been declining for some years past. In 1880-81 the *exports* to foreign countries were valued at Rs. 8,20,257, but the returns for that year were the highest on record. For subsequent years they were as follows:—1883-84, Rs. 5,68,334; 1885-86, Rs. 5,60,012; and 1887-88, Rs. 2,04,858. In 1883-84, the United Kingdom received of the above, cardamoms to the value of Rs. 4,05,649, but last year only Rs. 52,658.

After the United Kingdom the other receiving countries are generally in the following order of importance:— Arabia, Germany, Persia. On the other hand, the *imports* of foreign cardamoms seem to be on the increase. In 1880-81 they were valued at Rs. 4,134, and taking the same years as have been given for the exports, the imports were in 1883-84, Rs. 18,351; 1885-86, Rs. 92,205; and 1887-88, Rs. 2,60,450.

During this year the bulk of the imports (*viz.*, Rs. 2,51,211 worth) came from Ceylon, and of the total of these foreign imports, Bombay received Rs. 2,16,455 worth. Of the internal trade in cardamoms, full statistics are not available, but excluding the transfrontier trade by land, it was last year valued at Rs. 25,11,053.

In Travancore the cardamom cultivation and trade are a monopoly of the State. The drug is grown on the Cardamom Hills, and is brought down, under guard, to Alleppy to be exported. The following table gives a Statement of the sale of Travancore cardamoms during the last sixteen years:—

Statement of the Sale of Travancore Cardamoms, 1875 *to* 1891.

Year M. E.	Cardamoms in candies of 600 E. lbs.	Average price per candy in Rupees.	Total amount realized.
		Rs.	Rs.
1051	275	838	2,30,268
1052	47	1,600	74,692
1053	133	1,719	2,28,526
1054	140	2,353	3,28,176
1055	248	1,966	4,87,596
1056	188	1,833	3,44,320
1057	158	1,427	2,25,855
1058	62	1,825	1,13,397
1059	303	1,018	3,08,601
1060	484	769	3,72,278
1061	148	682	1,01,101
1062	88	863	75,892
1063	256	492	1,26,058
1064	176	776	1,36,018
1065	84	590	49,787
1066	326	534	1,74,847

This table includes all cardamoms sold. Some will be exported by sea and some sent by backwater to Cochin, so what is sent to Cochin will also appear as exports from that Port.

The following notes have been kindly furnished by Mr. T. F. Bourdillon, Conservator of Forests, Travancore, late Superintendent of the Cardamom Hills:—

The cardamom plant is indigenous in the evergreen forest of Travancore, between the elevations of 400 and 4,000 feet, but thrives best at the higher of these altitudes.

The spice is divided into 3 classes: (1) *Magara ēlam,* or those cardamoms which ripen in the month of Magaram (January); (2) *Kanni ēlam,* those which ripen in the month of Kanni (September); and (3) *Nēēla ēlam,* or long cardamoms.

The first two classes grow on the same variety of the plant, the whole plant being smaller than that of the long variety, and the difference in the time of ripening is due to differences of altitude and climate.

The scapes on which the capsules are borne, in the case of the first two classes, always trail on the ground, whereas the scapes of the long cardamoms stand erect, and are often 2½ ft. high.

Magara ēlam are considered the best. The plants that produce them are grown at an elevation of 3,000 ft. and upwards on the eastern edge of the Travancore Territory, where the rainfall is comparatively light, reaching probably not more than 60 inches. In this comparatively dry district the capsules take longer to mature, and though the plant flowers in March and April, at the same time that it flowers elsewhere, the capsules do not ripen till January, and are considerably larger and contain more seed than the other kinds.

Kanni ēlam come second. The capsules are very round and sweet, but are smaller than those of the *Magara ēlam.* The plants which produce them grow at elevations between 1,000 and 2,500 ft., in a moister (100—200 inches) and more forcing climate than the others, and the fruit ripens more quickly.

Nēēla ēlam come last. The plants are larger, and the scapes stand upright as already said. The capsules are long and less aromatic than those of the other two kinds. This variety is found on the hills of South Travancore, where the rainfall is heavy (150—200 inches) and where the sea breezes blow. The elevation is between 1,000 and 3,000 ft.

Although cardamoms are wild in the forests, they have been cultivated in gardens from time immemorial, and from old records it is seen that the oldest gardens which were in existence when Lieut. Ward made his survey of the country in 1817 are still the most productive. These gardens are found on the eastern edge of the Travancore hill-plateaux, where the *Magara ēlam* are produced, and this variety yields about ¾ of the total produce of the country. Some gardens are met with in the *Kanni ēlam* district, but these are more modern, and the yield is about ⅙ of the total crop each year. "Long cardamoms" are not grown in gardens; they are all collected wild from the forests.

When a person intends to open a garden, and has obtained permission to do so (for cardamoms are still a monopoly in Travancore), he selects some heavy forest, where there are already a few plants of cardamoms growing, carefully avoiding those places where reeds grow, as indicating poor soil. The common saying is that where the Anjili (*Artocarpus hirsuta*) and white cedar (*Dysoxylon malabaricum*) grow, there cardamoms will thrive.

The smaller trees and undergrowth are then cut down, only the larger trees being left to form a close canopy overhead. The garden is then kept clear of weeds by a cutting over and weeding twice a year, and cardamom seeds are sprinkled about, or the rhizomes are planted out when the plants have not come up properly. In about 3 years the garden begins to bear, and may continue to do so for upwards of a century if the light is not allowed to enter too much. Should any of the larger trees fall down and let the light in, the cardamom plants turn yellow and give a heavy crop, but then die out until shade has been again allowed to grow up.

Each year when the cardamoms ripen, they are collected and dried on rocks, and when thoroughly dried they are delivered to the Cardamom Superintendent, who weighs them in and despatches the crop under escort to the Court, where it is sold, and the grower gets two-fifths of the price realised at the annual auction, the Government retaining the other three-fifths.

The crop yielded per acre is not large, and, indeed, a heavy crop is a disadvantage, as it would imply that the garden was about to die out. Equal crops of good full capsules are to be desired, and as the trees above drop their leaves and manure the plants below, no further manuring is necessary, though it is generally admitted that manuring would largely increase the crops were it feasible to carry out such operations.

It has been estimated that there are about 26,000 acres under cardamoms in Travancore, and 13,000 thulams (of 20 lbs. each) is a large crop. Even supposing that the area was much over-estimated, it is probable that the annual crop does not exceed 10 lbs. to the acre, though we have heard it placed at double that amount.

It will be seen by the figures quoted above that the crops of cardamoms in Travancore vary very considerably, the fact being that the setting of the blossom in March, April and May is very much dependent on the weather, frequent showers during those months being most favourable to a good crop, while a heavy monsoon is said to destroy the young fruit. Here too, as in the case of most fruit crops, a good year is followed by one or two bad ones and *vice versâ.*

Formerly, when Travancore used to supply the world with this spice, the price realized was very good, but since Ceylon and Curg cardamoms have come into the market, the price has fallen to about ⅛ of its former level, so that the annual amount realized by the Government hardly pays for the establishment required to watch and guard the crop from being stolen. The owners of gardens, who are chiefly villagers from the adjoining district of Madura in British India, scarcely secure any return for their work, and it is now in contemplation to abolish the monopoly altogether.

A considerable proportion of the cardamoms in Indian commerce consists of the seeds, without the husks. These seeds are obtained from overripe fruits which have burst in the field or during manipulation, and are of two kinds, Indian and Chinese. The latter are said to be the seeds of *Amomum xanthioides*. (*Hanbury, Science Papers*, pp. 100, 178, 250, 291.)

Amomum subulatum, *Roxb.*, is much larger than the true cardamom, of a dark-brown colour and coarsely striated, three-valved, each valve being furnished with three ragged, membraneous wings, which extend from the upper part of the fruit and gradually disappear towards the apex. The seeds are arranged as in the true cardamom, but are more numerous, and are held together in each cell by a dark viscid saccharine pulp. Their taste is aromatic and camphoraceous. They are much used in the preparation of sweetmeats on account of their cheapness. Value, Rs. 12 per maund of 37½ lbs.

The **Nutmeg Cardamom,** or true **Cardamomum majus,*** made its appearance in the Bombay market in 1885. Up to that time the only large cardamoms we have met with have been the Bengal or Ceylon kinds. Under the name of Hil-bawa it is correctly described by the Arabian physicians, who no doubt were acquainted with the genuine article. Persian and Indian writers are evidently not acquainted with it, although they copy the description given by the Arabs.

The *Pharmacographia* has the following account of this rare Cardamom:—"The true *Cardamomum majus* is a conical fruit in size and shape, not unlike a small fig reversed, containing roundish angular seeds, of an agreeable aromatic flavour, much resembling that of the Malabar cardamom, and quite devoid of the burning taste of grains of Paradise. Each fruit is perforated, having been strung on a cord to dry; such strings of cardamoms are sometimes used by the Arabs as rosaries. The fruit in question is called in the Galla language *Korarima*, but is also known as *Guragi* spice, and by its Arabic names of *Heil* and *Hab-el-habashi.* According to Beke, it is conveyed to the market of Báso (10° N. lat.), in Southern Abyssinia, from Tumhe, a region lying in about 9° N. lat. and 350 E. long.; thence it is carried to Massowah, on the Red Sea, and shipped for India (?) and Arabia. Von Heuglin speaks of it as brought from the Galla country. It is not improbable that it is the same fruit which Speke saw growing in 1862 at Uganda, in lat. 0°, and which he says is strung like a necklace by the Wagonda people.

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* Valerius Cordus, Hist. Plant. iv., 28 ; Mathiolus i., 27.

ALPINIA OFFICINARUM, *Hance.*

Fig.—*Bentl. and Trim.*, *t.* 271. The lesser Galangal (*Eng.*), Petit Galanga, Galanga de la Chine (*Fr.*).

Hab.—China. The rhizome.

Vernacular.—Kulinjan, Pán-ki-jer (*Hind.*), Shitta-rattai (*Tam.*), Kulinjan (*Mar.*), Kulanjan (*Guz.*), Kunjara-kathi (*Sind.*), Sannaclumparásh-trakum (*Tel.*), Kalanjan (*Can.*).

History, Uses, &c.—The Chinese call the Galangals *Kaon-leang-keang* and *Liang-keang.* From the first of these names the Arabs have derived their name Khulanjan or Khowlanján, which is applied to the greater and lesser galangal, and is the source of the European name for these drugs. The same name occurs in the Nighanta's, which makes it evident that the Hindus first became acquainted with Chinese galangal through the Arabs. The earliest notice of the drug occurs in Persian literature (cf. *Burhan*), where it is stated that Khusrú-dárú, "Chosros remedy," was introduced in the time of Noshirwan (6th century). It probably reached Persia by the Central Asian trade route, as we find that it is still used by the Tartars to flavour their tea. Paulus Ægineta (7th century) calls it γαλάγγας, and latter Greek writers χαιλίζεν, γαλάβκας and κολουτζία. Ibu Khurdádbah (9th century), in enumerating the productions of a country called Sila, names galangal, and Edrisi, three hundred years later, mentions it as brought from

India and China to Aden. Ibu Sina and other early Arabian physicians also notice it shortly as a stomachic and stimulant. Curious stories as to its source were current in those days; Haji Zein states that in Yunán a kind of hawk is said by travellers to build its nest of the roots of the Khúlanján upon the sea-shore, and that the only way of obtaining the drug is to rob these nests; this the merchants do, and, after washing the roots, cut them up into short pieces.

Although this drug has been so long known, its botanical source was only discovered in 1870, when a description of the plant was communicated to the Linnean Society of London by Dr. H. F. Hance, made from specimens collected by M. E. C. Taintor near Hoihow, in the north of Hainan. (*Journal of the Linn. Soc.*, 1873, XIII., 6.)

Galangal is described by Serapion on the authority of Ishák bin Amrán as hot and dry in the third degree, useful to phlegmatic persons, and in humidity of the stomach; it promotes digestion by its heat and the solution which it occasions in the stomach, and thus relieves colic; gives fragrance to the breath, and warms the kidneys: it sets the semen in commotion, and when a piece of it is held in the mouth it occasions erections of the *membrum virile*. Other Arabian writers give a similar account of it. Indian Mahometan writers, with reference to the name Pán-kí-jar, say that the drug may be the root of very old plants of *Piper Betle*, but they are evidently in doubt about its being produced by that plant. (*Makhzan, article "Khúlanján."*) Mír Muhammad Husain describes Galangal as tonic, stomachic, carminative, stimulant, and aphrodisiac. He tells us that if given to young children it makes them talk early, and that a paste of the powdered drug made with oil or water will remove freckles. It is a stomachic tonic, used by native practitioners to reduce the quantity of urine in diabetes. It is used to correct foul breath when chewed, and the juice swallowed stops irritation in the throat. (*Emerson.*) Galangal is one of the ingredients of Warburg's tincture. It is not used in English medicine, but there is a considerable demand for it in Russia, where it is used for a variety of purposes, as for flavouring the liqueur called *Nastoika*, it is also employed by brewers, and to impart a pungent flavour to vinegar, a use noticed by Pomet so long ago as 1694. As a popular medicine and spice, it is much sold in Livonia, Esthonia, and in Central Russia. It is also in requisition as a cattle medicine, and all over Europe there is a small consumption of it in regular medicine (*Hanbury*). Irvine (*Med. Topog. of Ajmeer*, p. 171) says that the natives add Kulijan to bazar spirit to make it more intoxicating.

Description.—The dried rhizomes are about as thick as the little finger or often less. They have evidently been cut into short lengths (2 to 3 inches) while fresh; many of the pieces are branched, and all are marked by numerous circular ridges of a light colour. The external surface of the rhizome is of a deep reddish-brown, the interior pale red, hard and tough; the odour is aromatic and the taste hot and spicy.

Microscopic structure.— The bulk of the rhizome consists of a uniform parenchyma traversed by fibro-vascular bundles, some of the parenchyme cells are full of resin and essential oil, but most of them contain large starch grains of an elongated or club-shaped form.

Chemical composition.— Galangal contains from $\frac{1}{5}$ to $\frac{1}{2}$ per cent. of an essential oil, which is the odorous principle; according to Vogel, its formula is $C^{10}H^{16}O$. Brandes extracted from Galangal with ether a neutral, inodorous, tasteless, crystalline body, *Kæmpferide.* E. Jahns (1883) has isolated the following compounds from the root: *Kämpherid*, $C^{16}H^{12}O^{6}H^{2}O$, crystallizing in yellowish needles (m. p. 221°), which are slightly soluble in water, ether and benzine, freely soluble in alcohol, soluble in alkalies to an intensely yellow solution, and in concentrated sulphuric acid to a yellow solution with a strong blue fluorescence. *Galangin*, $C^{15}H^{10}O^{5}H^{2}O$, crystallizing from its solution in aqueous alcohol in yellowish-white needles (m. p. 214°). The reactions of this body are very similar to those of kampherid; its solution in concentrated sulphuric acid, however, is non-fluorescent.

Alpinin, $C^{17}H^{12}O^{6}$, crystallizes in yellowish needles (m. p. 173°). Its reactions are similar to those of galangin. (*Archiv. der Pharm.*, CCXX., 161; *Year-Book of Pharmacy*, 1882, p. 199.) The resin, which is probably the acrid principle, has not been examined.

Dr. Thresh (1884) has isolated from Galangal root an active pungent principle, which he has named *Galangol*, and which resembles the pungent principles of Ginger, Capsicum, and grains of Paradise in certain respects. He records the following proximate analysis of 100 parts of the rhizome:—Volatile oil 0·6, resin 0·2, fat and *Galangol* 1·6, kampferid, &c., 1·4, other saline matters soluble in ether but not precipitated by Pb. A^2 1·2, tannin 0·6, phlobophane 1·2, other substances soluble in alcohol 3·2, glucose, mucilage, &c., 3·5, oxalic acid 0·3, galangal red 2·8, starch 23·7, albuminoids 2·6, moisture 13·8, ash 3·8, cellulose, &c., 39·5. The active principle could not be isolated in a state of purity.

Commerce.—The imports of Galangal into India average 3,300 cwts. yearly. In 1883-84 they amounted to 3,870 cwts., valued at Rs. 35,982, of which Calcutta took 686 cwts., Bombay 1,750 cwts., and Madras 1,434 cwts. Of the total imports 1,230 cwts. came from Hongkong, 2,540 cwts. from the Straits Settlements, and 100 cwts. from other countries. During the same year 1,670 cwts. were re-exported to Arabia and Persia.

Galangal is valued in Bombay at about Rs. 3½ per maund of 37½ lbs.

ALPINIA GALANGA, *Willd.*

Fig.—*Rumph. Amb. v.*, *t.* 63. The greater Galangal, Java Galangal (*Eng.*), Galanga grand, Galanga de Java (*Fr.*).

Hab.—Java, Sumatra, Southern India. Cultivated in Bengal. The rhizome.

Vernacular.—Bara-Kulinjan (*Hind.*, *Guz.*), Motha-kolanjan, Kosht-kolanjan, Malabari-kolanjan (*Mar.*), Pera-rattai (*Tam.*), Pedda-dumparash-trakan (*Tel.*), Pera-ratta (*Mal.*).

History, Uses, &c.—The great Galangal is known in China by the same names as the lesser Galangal, and does not appear to have been distinguished from the latter drug by the Greeks, Arabs or Persians. Hanbury (*Science Papers*, p. 373) remarks that Garcia D'Orta was the first writer to point out (1563) that there are two kinds of Galangal—the one, as he says, of smaller size and more potent virtues, brought from China, the other, a thicker and less aromatic rhizome, produced in Java. Loureiro describes the plant which produces it under the name of *Amomum Galanga*, and gives Câo Leâm Kiâm as its name in Cochin-China. Roxburgh (i., 60) fully describes the plant grown in Calcutta from roots sent to him by Dr. Charles Campbell from Bencoolen, and quotes a note by Mr. Colebrooke to the effect that the roots are the Kulanjana of the Raja Nirghanta, and the Sughanda-vacha and Malabari-vacha of the Bhavaprakasha. From the latter name it appears that the Hindus regard the plant as a native of Malabar or of Western India; the correctness of this opinion has been confirmed by Dalzell and Gibson, who found it growing truly wild upon the Wagh Dongar or "tiger hill" in the Southern Concan. (*Bomb. Fl.*, p. 274.) The root of the Indian plant does not, however, appear to have been collected for commercial purposes until a comparatively recent date, which has given rise to the supposition that the plant is not a native of India. At the present time it is cultivated both in Malabar and Bengal.

The fruits of *A. galanga* furnish the Galanga Cardamom. In the fresh state they are of the size of a small cherry, obovate, smooth, and of a deep orange-red colour. Hanbury (*Science Papers*, p. 252) describes the dried fruit (*Kaon-leang-keang-tsze*, Chinese) as about half an inch in length, of an oblong form, somewhat constricted in the middle, or occasionally pear-shaped; some obscurely 3-sided. Each fruit prominently crowned with the remains of the calyx; in a few the lower extremity still attached to a slender pedicel. Most of the capsules much shrivelled on the outside, a few plump and smooth. Pericarp from pale to deep reddish-brown, glabrous, thin. Seeds united in a 3-lobed mass, completely invested in a whitish integument, each cell or lobe containing usually two, placed one above the other; these are ash-coloured, flattish, and somewhat 3-angled, finely striated, and have a pungent taste like that of the root. (*For figure, see Science Papers*, p. 107.)

The root is readily distinguished from that of *A. officinarum* by its larger size, feebler odour and taste, orange-brown exterior and yellowish-white interior. The statistics of Indian commerce do not enable us to distinguish this drug from China galangal.

It is valued in Bombay at about Rs. 50 per candy of 7 cwts. Galangal cardamoms are not found in Indian commerce.

In the Kew *Bulletin* for January 1891 (p. 5) an interesting account is given of the identification of the plant yielding the rhizome employed to make the well-known Chinese preserved ginger. As long ago as 1878, Dr. E. Percival Wright, of Trinity College, Dublin, called the attention of Mr. Thiselton Dyer to the fact that the preserved ginger has very much larger rhizomes than *Zingiber officinale*, and that it was quite improbable that it was the produce of that plant. The difficulty in identifying the plant arose from the fact that, like many others cultivated for the root or tuber, it rarely flowers. The first flowering plant was sent to Kew from Jamaica by Mr. Harris, the Superintendent of the Hope Garden there. During the past year the plant has flowered both at Dominica in the West Indies and in the Botanic Garden at Hongkong. Mr. C. Ford, the Director of the Botanic Garden at Hongkong, has identified the plant as *Alpinia galanga*, the source of the greater or Java galangal root of commerce. Mr. Watson, of Kew, appears to have been the first to suggest that the Chinese ginger plant is probably a species of *Alpinia*, and possibly identical with the Siam ginger plant, which was described by Sir J. D. Hooker in the *Botanical Magazine* (tab. 6946) in 1887 as a new species, under the name of *Alpinia zingiberina*. Mr. J. G. Baker, in working up the Scitamineæ for the 'Flora of British India,' arrived at the conclusion that it is not distinct from the *Alpinia galanga*, Willd. The Siam and Chinese gingers are therefore identical, and both are the produce of *Alpinia galanga*, Willd. *Pharm. Journ.*, Jan 31st, 1891.

MUSA PARADISIACA, *Linn.*

Fig.—*Roxb. Cor. Pl. iii., t.* 275; *Rheede, Hort. Mal. i. tt.* 12—14. Plantain (*Eng.*), Bananier (*Fr.*).

Hab.—Cultivated throughout India. The fruit, leaves and stems.

Vernacular.—Kéla (*Hind., Guz.*), Kala (*Beng.*), Kél (*Mar.*), Vazhai-pazham (*Tam.*), Anati-pandu, Amti-pandu (*Tel.*), Báli (*Can.*).

History, Uses, &c.—The cultivated plantains are called Kadali in Sanskrit, and the wild plantains, which, we believe, to be their progenitors, Aranya-kadali and Rambhà. There are many synonyms, such as Bhánuphala or Ansumatphala "having luminous fruit," Chárupbala "having delicious fruit," Rájeshta "liked by kings," Vana-lakshmi "beauty of the woods," &c. We think there can be little doubt that the plantain has been under cultivation in India from prehistoric times. The Greeks under Alexander must have become acquainted with it; Theophrastus and Pliny describe a tree called *Pala*, with leaves like the wing of a bird, three cubits in length, which puts forth its fruit from the bark, a fruit remarkable for the sweetness of its juice, a single one (bunch?) containing sufficient to satisfy four persons; this tree is supposed to have been the plantain. The word *pála* signifies "leaves," but we are not aware of its ever having been applied to the plantain. The Arabs call it *Mauz* and *Talk*, and under the latter name it is mentioned in the Koran—و اسحاب اليمين ما اصحاب اليمين* فی سدر مخضود و طلح منضود (and the companions of the right hand, happy companions of the right hand among Lotus trees free from thorns, and plantains with their lapping clusters of fruit).

Under the name of Mauz, Mesne describes the fruit as useful in soreness of the throat and chest with dry cough, and in irritability of the bladder; he considers it to be aphrodisiac, diuretic and aperient, and recommends it to be cooked with sugar or honey. Eaten in excess it gives rise to indigestion. Abu Hanifeh in the 9th century described very accurately the manner of growth of the plantain, and quotes a saying of Ash'ab, to his son, as related by As, "Wherefore dost thou not become like me?" to which he answered, "Such as I is like the *Mauzah*, which does not attain to a good state until its parent dies." (*Madd-el-kamus.*) The early Italian travellers called the plant *Fico d'Adamo*, and thought they saw in the transverse section of the fruit a cross or even a crucifix. Mandeville calls it the Apple of Paradise. The varieties of the plantain are very numerous; Rumphius describes sixteen (*Herb. Amb.*, viii., 2). Some of these, like the large yellow *Manyel*, are only used after they have been cooked; others, as the *Iclâhi*, are small and delicate in flavour. The abortive flowers at the end of the spike are removed and used as a vegetable by the Hindus, and the unripe fruit, called *Mochaka* in Sanskrit, is used medicinally on account of its astringent properties in diabetes; it is made into a *ghrita* with the three myrobalans and aromatics. Young plantain leaves are universally used as a cool dressing for blisters and to retain the moisture of water dressings; they serve also as a green shade for the eyes. Emerson notices the use of the sap to allay thirst in cholera. Mír Muhammad Husain in the *Makhzan* tells us that the centre of the stem, *Kanjiyál*, is eaten with fish as a vegetable in Bengal, that the kind called *Málbhok* is used as a poultice to burns, and that called *Bolkad* is boiled and used as an ointment to the syphilitic eruptions of children; he also notices the use of the ashes on account of their alkaline properties, and of the root as an anthelmintic. MM. Corre and Lejanne state that the fruit stems sliced and macerated in water all night, yield a sudorific drink; and that the charcoal of the skin of the fruit is recommended by Chevalier as an application to the cracks in the sole of the foot from which Negroes suffer. Pereira (*Mat. Med.*, ii., p. 222) has drawn attention to the nutritive properties of the meal prepared from the fruit. In India the lower portion of the stem of the wild plantain is a valuable resource in famine seasons on account of the large quantity of starch it contains. Starch prepared from the unripe fruit is used in the treatment of bowel complaints in Bengal. A specimen we examined consisted almost wholly of pure starch, with a trace of astringent extractive. In America a syrup of bananas is said to be singularly effective in relieving chronic bronchitis. The preparation is simple, requiring only that the fruit shall be cut in small pieces and with an equal weight of sugar be placed in a close jar, which is set in cold water and slowly heated to the boiling point, when it is to be removed from the fire and allowed to cool. The dose mentioned is a teaspoonful every hour.

Chemical composition.—Professor Johnston, in the *Journal of the Agricultural Society of Scotland*, says: "We find the plantain fruit to approach most nearly in composition and nutritive value to the potato, and the plantain meal to that of rice. Thus the fruit of the plantain gives 37 per cent., and the raw potato 25 per cent., of dry matter. In regard to its value as a food for man in our northern climates, there is no reason to believe that it is unfit to sustain life and health; and as to warmer or tropical climates, this conclusion is of more weight." The only chemical writer who had previously made personal observations upon this point (M. Boussingault), says: "I have not sufficient data to determine the nutritive value of the banana, but I have reason to believe that it is superior to that of the potato. I have given as rations to men employed at hard labour about 6½ pounds of half-ripe bananas and two ounces of salt meat." Of these green bananas he elsewhere states, that 38 per cent. consisted of husk, and that the internal eatable part lost 56 per cent. of water by drying in the sun. The composition of the ash of the plantain also bears a close resemblance to that of the potato. Both contain much alkaline matter, potash and soda salts; and in both there is nearly the same percentage of phosphoric acid and magnesia. The growing parts of the plant contain much tannic and gallic acids. The sound ripe fruit contains as much as 22 per cent. of sugar, 16 per cent. being crystallizable. In the native sugar-cane the proportion of cane sugar, according to Payen, is 18 per cent. After the plantain has become quite ripe, there is a rapid diminution in the proportion of crystallizable sugar and an increase in the proportion of inverted sugar; an over-ripe fruit contained only 2·84 per cent. of crystallizable and 11·84 per cent. of uncrystallizable sugar, being a total of 14·68 per cent. or two-thirds of the original quantity.

For the following analyses of E. Indian plantains we are indebted to Assistant Surgeon C. L. Bose, Calcutta. The samples represent the most commonly-used varieties:—

Percentage of Pulp and Pericarp in Ripe Fruit.

Variety.	Pulp.	Pericarp.
Kantali	70·85	29·15
Champa	74·37	25·63
Chattim	86·02	13·98

Percentage Composition of Pulp.

Variety.	H_2O.	Ash.	Alkalinity of Ash in terms of Normal KHO.	Cane Sugar.	Grape Sugar.	Total Sugar.	Gum.	Total acidity of Pulp in terms of Normal NaHo.	Fat.	Total N.	Albuminoids, N × 6·25.	Non-nitrogenous extractives by difference.
Kantali	67·68	·77	7·09 c. c.	8·36	7·75	16·11	·48	8·90 c. c.	·058	·2	1·85	13·657
Champa	71·47	·97	8·08 c. c.	...	...	14·15	·401	7·87 c. c.	·135	·288	1·80	11·109
Chattim	73·32	·73	7·34 c. c.	10·37	7·41	17·78	·36	4·57 c. c.	·00	·24	1·50	6·81

König gives the following as the composition of the fruit from Brazil and Venezuela—the first analysis being by Corenwinder, and the other by Marcano and Müntz:—

	Brazil.	Venezuela.	*Mean.*
Water	72·40	73·8	73·10
Albuminoids	2·14	1·60	1·87
Fat	·96	·30	·63
Nitrogen free extractive	23·09	23·00	23·05
Cellulose	·38	·20	·29
Ash	1·03	1·10	1·06

The fruit consisted of about 40 per cent. pericarp and 60 per cent. pulp. The pericarp afforded 14·7 per cent. of solid residue, containing 1·6 per cent. of grape sugar. The anhydrous fruit from Brazil contained 1·24 per cent. nitrogen and 83·66 per cent. carbohydrates; that from Venezuela, ·97 per cent. nitrogen and 87·78 per cent. carbohydrates. Plantain meal from Venezuela had the following percentage composition:—

Water	14·90
Albuminoids	2·90
Fat	·50
Nitrogen free extractive	77·90
Cellulose	1·60
Ash	2·20

The nitrogen free extractive from the ripe fresh fruit and meal had the following composition:—

	Brazil.	Venezuela.	Meal.
Cane sugar	15·90	5·90	1·52
Grape sugar	8·50	6·40	3·30
Starch	·60	·40	66·10

The ash of the fruit from Brazil had the following percentage composition:—Potassium sulphate, 3·61; Potassium chloride, 14·34; Magnesium phosphate, 8·77; Potassium oxide, 27·12; Potassium carbonate, 41·66; Calcium carbonate, 1·17; Oxide of iron, ·36; Sand, 2·06 per cent.

The ash of the husk of the ripe fruit was found to contain 47·98 carbonate of potash, 6·58 carbonate of sodium, 25·18 chloride of potassium, 5·66 alkaline phosphates (with a little sulphate), 7·50 charcoal, 7·10 lime, silica, earthy phosphates, &c. In the juice of the flower stem of the same plant, Comnille (*J. Pharm.* (3) 43, 269) found 25·27 per cent. potash, 9·52 soda, 15·85 lime, 5·0 magnesia, 0·87 alumina, with a trace of ferric oxide, 6·30 chlorine, 0·96 sulphuric anhydride, 0·87 phosphoric anhydride, 0·81 silica, and 34·17 carbonic anhydride (calculated from the bases).

Commerce.—Dried plantains are an article of commerce in India, and are excellent when stewed with sugar or fried in butter. Bombay exports annually from 300 to 400 cwts.

CANNA INDICA, *Linn.*

Fig.—*Rheede, Hort. Mal. xi., t.* 43. Indian Shot or Bead (*Eng.*), Balisier (*Fr.*).

Hab.—Uncertain. Common throughout India in gardens and cultivated ground. The fruit and root.

Vernacular.—Sabba-jaya, Akalbar (*Hind.*), Sarba-jaya (*Beng.*), Kandámani-cheddi (*Tam.*), Krishna-tamara (*Tel.*), Kátú-búla (*Mal.*), Sugundaraju-gida (*Can.*), Deokeli, Kámákshi (*Mar.*).

History, Uses, &c.—This plant, though common everywhere, is not truly wild in India; how and from whence it has been introduced is not known; it occurs also in Burma and Ceylon, and the seeds are used as prayer-beads by the Burmese. In the West Indies, especially in St. Kitts, a nearly allied species is cultivated for its starch, which is known as "*Tous les mois*" or "*Fécule de Tolomane,*" and is remarkable for the great size of its starch grains. No starch is prepared in India from *C. indica*, but its fruit and root are used medicinally by the natives. The flowers are sacred to Shiva and Durga, as is indicated by the Hindi, Bengali, and Marathi names which are derived from the Sanskrit Sarva-jaya "all conquering" (Shiva), and Kámákshi, a name of the goddess Durga. In the *Dict. Econ. Prod. of India,* the Sanskrit name Silarambha is wrongly attributed to this plant, it is properly the name of the wild plantain or Káshtha Kadali. Rheede, describing the medicinal uses of *C. indica*, says:—"E fructibus parvum tostis succus elicitur, qui auribus immissus dolores illarum mitigat. Ex iisdem et saccharo massa componitur, et umbilicali regioni applicatur contra diabetem, ex calidis febribus ortam. Succus radicis Mercurii sublimati toxicum infringit." Atkinson (*Him. Dist.* 730) states that the root is used as a diaphoretic and diuretic in fevers and dropsy. When cattle have eaten any poisonous plant, which is generally discovered by the swelling of the abdomen, the natives administer to them the root of this plant, which they break up in small pieces, boil in rice-water and pepper, and give them to drink. (*Drury.*) Baden-Powell (*Punj. Prod.* 382) states that the seeds are considered to be cordial and vulnerary.

Description.—An herbaceous plant, 2-3 feet; leaves large, ovate-lanceolate, stem-clasping; flowers bright scarlet or yellow, inner wing of the corolla trifid, segments lanceolate, straight; anther single, attached to the edge of the corolla; capsule bristly, 3-celled, many-seeded; seeds round, black, hard and shining, the size of a pea or buck-shot.

Chemical composition.—The seeds reduced to powder were exhausted with alcohol, and the alcoholic extract mixed with water acidulated with sulphuric acid, and agitated with petroleum ether, then with ether, and after the addition of an alkali, again with ether.

The petroleum ether extract contained yellowish fatty matter, from which white nodules separated on standing, the taste was camphoraceous and somewhat pepper-like. The acid ether extract had the odour of vanilla; it was partly soluble in water with acid reaction, the aqueous solution giving a bright green coloration with ferric salts, slightly precipitating gelatine, but giving no reaction with potassic cyanide.

No alkaloidal principle was detected in the ether extract, the amount of which did not exceed a trace.

The fresh roots were contused, and treated in the same manner as the seeds. The taste of the alcoholic extract was slightly pungent with a flavour of ginger. The petroleum ether extract was yellow and consisted of resinous and fatty matters; it was partly soluble in absolute alcohol, the solution giving a dirty-green precipitate with ferric chloride. The acid ether extract was partly soluble in water, and the solution gave a sage-green coloration with ferric chloride, precipitated tannin, but gave no reaction with potassic cyanide. The portion insoluble in water was nearly wholly soluble in ammonia, affording a deep yellowish-brown solution, from which acids precipitated yellowish flocks. The alkaline ether extract contained traces of an alkaloid which failed to afford any special colour reactions.

The seeds have been stated by Dalzell and Gibson (*Bombay Flora*) to afford a beautiful but evanescent dye; we failed to detect the presence of any such dye principle in either the seeds or roots. The roots contain mucilaginous matter and starch; starch was also present in the seeds.

IRIDEÆ.

IRIS GERMANICA, *Linn.*

Fig.—*Bot. Mag.*, *t.* 670; *Bot. Reg.*, *t.* 818. Orris root (*Eng*)., Racine d'Iris (*Fr.*).

Hab.—Central and Southern Europe, Northern India, and Persia. The rhizome.

Vernacular.—Bikh-i-banafshah, Keore-ka-mul (*Ind. Bazars*).

History, Uses, &c.—We have already stated (Vol. II., p. 296) that we consider Orris root to be the Pushkara-mula of Sanskrit writers, though it is not now recognised as such by the modern Hindus. It appears also to be the Kusht-el-bahri and Kusht-el-hali, "sweet costus," of the Arabs. The Greek name Iris is probably of Persian origin, and cognate with Aersa, and probably with Arastan, an old form of Árástan, "to adorn, to obey." Among Sanskrit synonyms for Pushkara-mula, we find Padma-pushkara "blue lotus," Pushkaránghrija "born of the lotus root," Pushkaráhva "challenging the lotus," Pushákarasgara "sea lotus," and Kasmira "Cashmerian"; at the present time *I. nepalensis* is called "blue lotus" in Kumaon. The root is described as having properties similar to costus, and appears to have been regarded by both Hindus and Arabs as a kind of costus. In the Burhán the plant is said to be called Irsa, because its flowers are blue, yellow and white like the rainbow; it is also called in Persia Susán-i-asmánguni, "sky-coloured lily." The Iris is mentioned by Theophrastus (H. P. iv., 7; ix. 7), Dioscorides (i., 1), and all the Greek medical writers which we have consulted. A celebrated unguent, the ἴρινον μύρον, was prepared from the root for which Macedonia, Elís and Corinth were famous. Visiani (*Fl. Dalmat.*) considers that the *I. germanica* is the Illyrian iris of the ancients, which is highly probable, seeing that throughout Dalmatia (the ancient Illyricum) that species is plentiful, and *I. florentina* and *I. pallida* do not occur. According to Hooker, *I. germanica* is cultivated in Cashmere, but we have not heard of its being under cultivation in Persia. The Persian name of this drug, Bikh-i-banafshah, is applied also to the root of *Viola odorata* in Southern India.

Iris root is considered by Mahometan hakíms to be deobstruent, aperient, diuretic, especially useful in removing bilious obstructions. It is also used externally as an application to small sores and pimples. From the large number of diseases in which this drug is recommended, it would appear to be regarded as a panacea.

Description.—Eastern orris root differs from the European drug, inasmuch as the bark of the rhizome has not been removed; it is also smaller and of a darker colour.

Microscopic structure.—The rhizomes of different species of Iris hardly differ in structure. They consist of a brown epidermis composed of compressed and nearly empty cells, covering a white cortical cellular tissue containing starch; this is separated by a layer of brownish compressed empty cells from the central woody yellowish tissue of the rhizome. The latter is built up of large thick-walled, spherical, porous cells, loaded with starch; here and there between the cells may be seen a prism of oxalate of lime. The vascular bundles are numerous, in each irregular rings of spiral vessels surround a central bundle of jointed vessels.

Chemical composition.—The authors of the *Pharmacographia* say:—"When Orris root is distilled with water, a solid crystalline substance, called *Orris Camphor,* is found floating on the aqueous distillate. This substance, which we obtained from the laboratory of Messrs. Herrings & Co., of London, is yielded, as we learn from Mr. Umney, to the extent of 0·12 per cent., that is to say, 3 cwt. 3 qrs. 23 lbs. of rhizome afforded of it 8½ ounces. Messrs. Schimmel & Co., of Leipzig, also presented us with the same substance, of which they obtain usually 0·60 to 0·80 per cent. Orris camphor has the exquisite and persistent fragrance of the drug; we have proved that this presumed stearoptene or Camphor of Orris root consists of *myristic acid,* $C^{14}H^{28}O^{2}$, impregnated with the minute quantity of essential oil occurring in the drug. The oil itself would appear not to pre-exist in the living root, but to be formed on drying it.

"By exhausting Orris root with spirit of wine, a soft brownish resin is obtained, together with a little tannic matter. The resin has a slightly acrid taste; the tannin strikes a green colour with persalts of iron."

Commerce.—India is supplied with Orris root from Persia and Cashmere. The average value is about 2 annas per lb.

CROCUS SATIVUS, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 274; *Woodv.*, *t.* 259; *Royle, Ill.*, *t.* 90. Saffron (*Eng.*), Saffran (*Fr.*).

Hab.—Greece, Asia Minor, Persia. Cultivated elsewhere. The stigmas with portions of the styles.

Vernacular.—Késar (*Hind.*), Késhar (*Mar.*, *Guz.*), Jáfrán (*Beng.*), Kunguma-pu (*Tam.*), Kunkuma-puvva (*Tel.*), Kunkumadahuvu, Késari (*Can.*), Kunkuma-puvva (*Mal.*).

History, Uses, &c.—Saffron, on account of its brilliant yellow colour, like that of the rising sun, has been especially valued by mankind from the earliest ages; in Sanskrit it bears the name of Kunkuma (a name also given in India to the red colour prepared from turmeric), and is described as Charu "fair," Vara "suitor," Agnisikha "having a crest of fire," Saurabha "fragrant," Mangalya "propitious," &c. In Persia the word *Zard*, derived from the Zend, signifies "yellow, and saffron," and the sun is called *Zard-ru* "yellow or golden-faced," and Zardah-i-kamrân "the fortunate yellow." Saffron is the Karkôm of the Hebrews, a name borrowed from the Persians, and in the *Song of Solomon* the beauty of the bride is likened to it. Amongst the Greeks κροκος signified both saffron and yellow; *Eos* or Aurora, the goddess of the morning, is clothed in it, and in Homer she is described as accompanying the Sun throughout the day.

Yellow, and plants having that colour, have also an erotic signification, hence we find them playing an important part in marriage ceremonies and the relations between the sexes: Juno in the *Iliad* is represented as preparing a bed of saffron and hyacinths when she wishes to tempt Jove, and Jayadeva in the *Gita Govinda* represents Hari as inviting Radha to repose upon a bed made of the saffron-coloured flowers of the Asoka. The following lines indicate the significance which is attached to this colour in popular estimation in India:—

Sánjh suni piyá ávan piyári, sundar nári singár banái,
Piar kesar, piar besar, piar hár liya larkái,
Piar chir diyo kamlápati, piar chandan de lagái,
Piar pán ki biri lagi, piyári piri bhai, piu nahin ái.

"The loved one heard that her lover would come in the evening, and made a grand toilette: yellow saffron, a yellow nose-ring, and a threaded necklace of yellow flowers. She has donned a yellow robe, applied yellow sandalwood, and placed ripe yellow betel leaves in her mouth. The damsel herself has grown yellow waiting for a lover who has not come."

The Grecian Hetairæ and also effeminate youths used to wear the κροκωτος, or "saffron-coloured garment," and the Arabs relate that Abu Jahl dyed his است (*ist*) with saffron, and was addicted to the enormity, termed ابنة (ubnah). He was a great enemy of the Prophet's, and is promised in the Koran a taste of Hell (و نذيقه يوم القيامة عذاب الحريق). A similar use of saffron by the libidinous old witch Zatel-Dawahi is mentioned in the 93rd night of the *Arabian Nights* :—وكان اكثر اقامتها عند ولدها حردوب ملك الروم لاجل الجوارى الابكار لانها كانت تحب السحاق وان تأخر عنها تكون في انمحاق وكل جاريه اعجبتها تعلمها الحكمة و تسحق عليها الزعفران فتغشى عليها من فرط اللذة مدة من الزمان

Magic properties are ascribed to saffron in Persia; Haji-Zein-el-Attár (1368) states that it is called Jádú-i-dihkán, "peasant's magic," and that pregnant women wear a ball of it, about the size of a walnut, at the pit of the stomach to ensure speedy delivery and expulsion of the after-birth. The saffron bag was not unknown in Europe in the Middle Ages, and even later. The Arabs believe that saffron kept in the house will drive away the lizard called *Sam Abras*, which they greatly dread; they also say of a man who is melancholy or a little odd انه لفي صفره (innahu lafi sufrihi), *i e.*, that he is in a state in which he requires to be rubbed with saffron.

Zardáb, or saffron water, is considered to have magical virtues in Persia, and we hear Indian conjurors ascribe the same virtues to turmeric water when they say *Pihalad áni ho gora* in the sense of "Hocus Pocus," &c. Saffron ink is used in India to write *Mantras* with. That auspiciousness is attributed to these plants on account of their colour, and not on account of any inherent properties, is shown by the fact that other plants furnishing yellow dyes are considered auspicious. In Persia *Delphinium Zalil* is much esteemed as a yellow dye, and is even brought to India for that purpose, where it bears the Sanskrit names of Tráyamána "preserving," Mangalya "auspicious," &c. It is quite possible that this plant was used in ancient Iran before saffron, as the word *tráyamána* occurs in old Persian with the meaning of "yellow." Dr. Aitchison speaks of *D. Zalil* as very common in Khorasan, and remarks that when in flower it gives a wondrous golden hue to the pastures.

A yellow colour is considered most auspicious in the East. Vasanta, or Spring, and Krishna are represented as clothed in this colour, and Vasanti-coloured garments are worn at the *Basant panchami* in many parts of India; at this season also garlands of yellow flowers are offered. This custom is alluded to in the *Báramása*, where the wife says:—

Nahin ghar kanth, leke basant ai ghar málan,
Main kaise pújún, sakhi, nahin ghar sájan.

"My husband is away, and the gardener's wife has brought (yellow) spring flowers. How can I make an offering, my dear, when my beloved is absent?"

A yellow garment, called *Basanti*, was worn by the Rajputs when about to sacrifice themselves in a desperate conflict, a sacrifice to their supposed ancestor Surya (the sun). Yellow is the favourite colour of the Buddhists, and the Sakya family was a branch of the great Solar race of Gautama. Sénart considers that the Buddha is the Sun-god, and that the details of his life have been taken from Solar mythology.

The use of saffron and turmeric for colouring and flavouring food is universal throughout India, and saffron is still used for this purpose in Germany, Switzerland, and in Cornwall, cakes made on festive occasions being coloured with it. There is a curious story about saffron-coloured rice in the Persian *Burhán*, where it is called Birinj-i-shamálah, "candle rice." The author relates that in former times there was a cook at Shiraz, who was in the habit of sitting by the roadside every evening and preparing a dish with yellow rice, before which he lighted two lamps, or sometimes two torches, and cried out—"Come to the rice of the candle," and repeated the following couplet:—

این شمعها که در دل بسحاق برفروخت از رهگذار نور برنج شماله بود

"The lights which burnt in the heart of Bushák were kindled by the passing of the light of the rice of the candle."

Who was Bushák, or Bashák? We cannot help thinking that he must have been some sturdy fire-worshipper testifying, as far as he dared, in the presence of a Mahomedan population, to his ancient faith. As the story was an old one when the

Burhán was written, it shows at any rate that the use of saffron-coloured rice in Persia is of great antiquity. The earliest European travellers in India called turmeric *Crocus indicus*, "Indian saffron," and evidently regarded it as a substitute for that article. In those days saffron was of much more importance in Europe than it is now, and the punishment for adulterating it was death.

Saffron was much employed by the Romans for seasoning food, and to make an essence with wine and water which was used as a perfume (*Pliny*, 21, 6, 17; *Lucretius*, ii., 416; *Ovid A. A.* 104, &c.). The name *Záfarán* occurs in the *Siháh* of El Jowhari who wrote in the 10th century, and from Arabian writers (Istakhri, Edrisi) we learn that it was cultivated at this time in Persia at Darband and Ispahán. It is not improbable that the plant was carried from that country to China, as, according to the Chinese, it was introduced by Mahometans. Chinese writers have recorded that under the Yuen dynasty (A. D. 1280—1368) it became the custom to mix Sa-fa-lang (Záfarán) with food (*Bretschneider, Chinese Botanical Works*, Foochow, 1870). Saffron appears to have been cultivated in Spain in the 10th century. The *Rája Nirghanta*, which was written about 600 years ago by a native of Cashmere, speaks of saffron as coming from Cashmere, and the plant is still cultivated there on the Kareewahs* near Pampur; the plants are arranged in parterres, and flower about the end of October; the inhabitants of the district are then summoned to gather the crop; during this time they live in the gardens which are guarded by police to prevent theft (*Ince, Handbook of Cashmere*).

The earliest medical writers mention saffron, and describe it as cardiacal and aphrodisiacal, improving the complexion, increasing the brilliancy of the eyes, and promoting the delivery of women. They also considered it to be diuretic, astringent, deobstruent, and emmenagogue. Saffron, formerly as highly esteemed in Europe as in the East, is still considered by some European physicians to have emmenagogue properties, but is generally regarded as a colouring and flavouring agent only. Saffron has recently been deleted from the drug list of the Medical Store Depôts in Bengal. For much interesting information concerning the early history of saffron in Europe, we would refer our readers to the *Pharmacographia* of Flückiger and Hanbury.

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* Alluvial flats from 100 to 200 feet high and 2 to 5 miles long, situated along the borders of the Cashmere Valley; they are separated from each other by deep ravines, and have the appearance of flat-topped hills.

Description.—Saffron consists of a small portion of the style and three long tubular stigmas of a rich orange colour; the upper extremity of each stigma spreads out to form a flat lamina with a dentate border. The stigmas simply dried and thrown together loosely, form the ordinary hay saffron of commerce. Persian saffron is, with the aid of some sticky material, pressed together so as to form a thin round flat cake; it is known in Bombay as *Késar-kí-roti* (bread saffron).

Chemical composition.—Flückiger and Hanbury have the following summary:—"The splendid colouring matter of saffron has long been known as *Polychroit;* but in 1851, Quadrat, who instituted some fresh researches on the drug, gave it the name of *Crocin*, which was also adopted in 1858 by Rochleder. The experiments of Weiss in 1867 have shown—

1st—That this substance (Polychroit, Crocin of Rochleder) is a peculiar glucoside, which, by the action of acids, splits into sugar, volatile oil, and a new colouring matter.

2nd—That saffron contains only a minute quantity of ready-formed essential oil and sugar.

3rd—That this free essential oil is probably identical with that which is produced in the decomposition of polychroit.

4th—That polychroit, as hitherto prepared, has always contained a certain proportion of the new colouring matter produced by decomposition."

For the natural glucoside, Weiss retains the name of polychroit, while the new colouring matter which results from its decomposition by an acid he terms crocin. It agrees with the crocetin of Rochleder.

Polychroit was prepared by Weiss in the following manner:—"Saffron was treated with ether, by which fat, wax, and essential oil were removed, and it was then exhausted with water. From the aqueous solution, gummy matters and some inorganic salts were precipitated by strong alcohol. After the separation of these substances, polychroit was precipitated by addition of ether. Thus obtained, it is an orange-red, viscid, deliquescent substance, which, dried over sulphuric acid, becomes brittle and of a fine ruby colour. It has a sweetish taste, but is devoid of odour, readily soluble in spirit of wine or water, and sparingly in absolute alcohol. By dilute acids, it is decomposed into crocin, sugar, and an aromatic volatile oil having the smell of saffron. Weiss gives the following formula for this decomposition:—

$$\underset{\text{Polychroit.}}{C^{48}H^{60}O^{18}}+H^{2}O=\underset{\text{Crocin.}}{2(C^{16}H^{18}O^{6})}+\underset{\text{Essential oil.}}{C^{10}H^{14}O}+\underset{\text{Sugar.}}{C^{6}H^{12}O^{6}}$$

Crocin is a red powder, insoluble in ether, easily soluble in alcohol, and precipitable from this solution on addition of ether. It is only slightly soluble in water, but freely in an alkaline solution, from which an acid precipitates it in purple-red flocks. Strong sulphuric and nitric acids occasion the same colours as with polychroit, the former producing deep-blue, changing to violet and brown, and the latter green, yellow, and finally brown. It is remarkable that hydrocarbons of the benzol class do not dissolve the colouring matter of saffron.

"The oil obtained by decomposing crocin is heavier than water; it boils at about 209°C., and is easily altered, even by water. It is probably identical with the volatile oil obtainable to the extent of one per cent. from the drug itself, and to which its odour is due.

"Saffron contains sugar (glucose?) besides that obtained by the decomposition of polychroit. It leaves after incineration 5 to 6 per cent. of ash." (*Pharmacographia*, p. 604.)

The investigation of the characteristic constituents of saffron, which had previously occupied the attention of several chemists, has been taken up by Herr Kayser (*Berichte*, xvii., 2228). By distilling saffron suspended in water in a current of carbonic anhydride, shaking the distillate with ether, and evaporating the ether in a current of carbonic anhydride, the essential oil was obtained as a very mobile, scarcely yellowish coloured liquid, having an extremely intense odour of saffron, readily becoming thick and brown by absorption of oxygen from the atmosphere, and giving upon analysis figures corresponding with the formula $C^{10}H^{16}$. Crocin was obtained by treating an aqueous extract, made without heat from saffron previously exhausted with ether, with purified animal charcoal, which removed all the colouring matter; then filtering, washing and drying the charcoal, boiling it with 90 per cent. alcohol and filtering. Upon removal of the alcohol the crocin was left as a brittle yellow-brown mass, yielding a pure yellow powder, freely soluble in water and dilute alcohol, less soluble in absolute alcohol, and giving up only traces to ether. With concentrated sulphuric acid it gave a deep blue solution, passing to violet, cherry red, and finally to brown; with nitric acid a deep blue, passing almost immediately to brown; with hydrochloric acid it underwent no change of colour. Acetate of lead produced no precipitate in a solution of crocin in the cold, but on warming the solution, decomposition at once took place, and the liquid then reduced Fehling's solution. As previous workers used lead acetate in the separation of crocin, Herr Kayser supposes that their product always contained crocetin. He attributes to pure crocin the formula $C^{44}H^{70}O^{28}$, and to crocetin $C^{34}H^{46}O^{9}$, the decomposition being represented by the following equation:—

$$2\,C^{44}H^{70}O^{28} + 7\,H^{2}O = C^{34}H^{46}O^{9} + 9\,C^{6}H^{12}O^{6}.$$

An ethereal extract of the residual saffron yielded a crystalline bitter substance, freely soluble in water and alcohol, less easily in chloroform and ether, and melting at 75°. This has been named "picrocrocin," and is represented by the formula $C^{38}H^{61}O^{17}$. It presents the interesting character that when warmed in aqueous solution with lead acetate, lime or baryta water or acid, it splits up into sugar and an essential oil, which has a strong odour of saffron and the composition of a terpene.

The following is the mean of two proximate analyses of saffron by G. Laube and Aldendroff, quoted by König:—

Water	16·07	per cent.
Albuminoids	11·74	,,
Fluid oil	·60	,,
Fat	3·22	,,
Sugar	15·33	,,
Non-nitrogenous extractive	44·57	,,
Cellulose	4·37	,,
Ash	4·37	,,

The anhydrous saffron contained nitrogen 2·24 per cent. and oil and fat 4·55 per cent.

Commerce.—Saffron is imported into Bombay from France, and occasionally from China. In 1882-83, the imports were 226 cwts., valued at Rs. 4,25,124; in 1886-87, 268 cwts., valued at Rs. 5,50,383. Most of it is adulterated; a sample examined by Lyon (1875) gave water 9·48, organic matter 56·93, mineral matter (chiefly carb. of lime) 33·59. This adulteration is easily detected by placing a pinch of the saffron in water, when the viscid substance used to make the lime adhere to it dissolves, and the lime falls to the bottom of the glass. Similar adulteration with other heavy powders has been recorded, and vegetable substances, as florets of marigold and safflower, fragments of petals, and fibres of grass and rush, have been found. Pure saffron costs in India Rs. 20 to 22 per lb. Cashmere saffron is exported to the Punjab, where it is much used as a dye, to the value of Rs. 20,000 yearly.

Pardanthus chinensis, *Bot. Mag.* 171, Syn. *Ixia chinensis*, Linn., is the *Balamcanda Schularmani* of Rheede (*Hort. Mal.*, xi., 37), and is a common garden plant in India, having flowers spotted like a leopard's skin. In Cochin-China, China, and the Doons of the Himalayas it grows wild. Loureiro states that the roots are used medicinally in Cochin-China, and that they have aperient and resolvent properties and purify the blood of gross humors, being specially useful in Cynanche. According to Rheede, it is used as an alexipharmic in Malabar, being given to those who have been bitten by the cobra, and to cattle who have fed upon poisonous plants.

AMARYLLIDEÆ.

CURCULIGO ORCHIOIDE, *Gärtn.*

Fig.—*Wight Ic., t.* 2043; *Roxb. Cor. Pl. i., t.* 13; *Bot. Mag., t.* 1076; *Rheede, Hort. Mal. xii., t.* 59.

Hab.—Hotter regions of India and Ceylon. The root.

Vernacular.—Músali, Músali-kand (*Hind., Mar., Guz.*), Nella-tádi (*Tel.*), Nela-pana-kelangu (*Mal.*), Nila-panai-kizhangu (*Tam.*), Tála-muli (*Beng.*), Nela-táli-gadde (*Can.*), Hín-bin-tal (*Cingh.*).

History, Uses, &c.—Both Hindu and Mahometan medical writers speak of a white and black Músali, which, from their descriptions, appear to have been different varieties of the same plant. In the *Rája Nirghanta* it is stated—मूषली च द्विधा प्रोक्ता श्वेता वापरासंज्ञका श्वेता स्वल्पगुणोपेता अपरा च रसायनी; the plant is described as Hemapushpi, "having golden flowers," and is considered to be alterative, tonic, restorative, and useful in piles, debility and impotence. It enters into the composition of several medicines intended to act as aphrodisiacs and restoratives. At the present time we meet with a white and black Músali in the bazars, but derived from two entirely different plants, viz., the *white* from an Asparagus, and the *black* from a Curculigo. We have been favoured with living specimens of the latter plant collected by Mr. B. B. Nené of Poona at Sitabaldi, and find that when cut and dried it exactly agrees with the bazar article which we have received from most parts of India. From Madras we have received a very small Curculigo root, from *C. brevifolia*, not more than an inch in length, whereas the root of the plant in general use is not less than 6 inches in length, and from ½ to ¾ inch in diameter. Dutt states that Satávari, the root of *Asparagus recemosus*, is sometimes sold by the druggists as white Músali; in Bombay the white Músali of the bazar is the root of *Asparagus adscendens*.

Native medical works give the following instructions for the collection of Músali:—Two-year old plants are to be selected, and the roots having been washed and cleared of rootlets, are to be sliced with a wooden knife, threaded upon a string, and dried in the shade; when dry they may be powdered. The dose is 180 grains, to be beaten up with an equal quantity of sugar in a small glass of water or milk until it forms a thick mucilage. Treatment to be continued for forty days, abstinence from mental and physical exercise being enjoined. Músalí is prescribed for asthma, piles, jaundice, diarrhœa, colic, and gonorrhœa; it is considered to be demulcent, diuretic, tonic, and aphrodisiac, and is often combined with aromatics and bitters. Hakim Sharafeddín in his *Mujarabát* has the following humorous anecdote in illustration of its restorative effects:—

من شروع بخوردن این دوا نمودم و پدر من جهت آنکه با زن خود
مقاربت نه نمایم مرا بریک جانب و زوجهٔ مرا بجانب دیگر خود میخوابانید
چون بیست روز از خوردن این دوا گذاشت از شدت قوت باه و شبق
نتوانستم صبر نمود شبی پای خودرا از بالای پدر دراز کرده زن خودرا
بران پا سوار نموده بدین طرف آوردم و با او مقاربت کرده باز برپا
سوار نموده بدانجانب فرستادم که دربین پای من لغزش نمود و اندک
فرود آمده و پای زن من بر شکم پدر رسیده از خواب بیدار شد گفت ای
ظالم چرا تا چهل روز صبر نکردي که این لغزش و ضعف هم نمیماند

The story at once suggests to the reader that in such cases چهل روز صبر is probably as good a tonic as Músalí.

Description.—Músalí occurs as short transverse sections of the root, half an inch or less in diameter, covered externally by a dark-brown bark; the substance of the root is opaque and greyish-brown; portions of the characteristic, wrinkled, vermicular rootlets may usually be found attached to some of the pieces. The taste is mucilaginous and slightly bitter.

Microscopic structure.—The fresh root of *C. orchioides* when cut across presents a firm milk-white, opaque surface, marked with numerous minute punctures. Thin sections show that it consists of a cortical and central portion, both composed mainly of a delicate parenchymatous tissue loaded with small starch granules, here and there a large cell contains a bundle of needle-shaped crystals. The large open passages which can be seen with the naked eye are almost entirely confined to the cortical portion ; they are lined by the walls of the neighbouring cells. In the central column are numerous bundles of spiral vessels which are mostly situated near its junction with the cortical portion. Many of the starch granules are muller-shaped.

Chemical composition.—A proximate analysis of the powdered roots was made with the following results :—

Ether ext. (fat, &c.)	1·28
Alcoholic ext. (resin, tannin)	4·14
Water ext. (mucilage)	19·92
Starch, &c., by difference	43·48
Crude fibre	14·18
Ash	8·60
Moisture	8·40
	100·00

The resin was soluble in spirit and alkaline solutions, and gave a fine red colour with strong sulphuric acid. The tannin gave a green colour with ferric salts, and when determined separately amounted to 4·15 per cent. of the root. Oxalate of calcium was present.

CRINUM ASIATICUM, var. TOXICARIUM, *Herbert.*

Fig.—*Bot. Mag., tt.* 1073, 2908, 2239; *Wight Ic., t.* 2021 ; *Rheede, Hort. Mal. xi., t.* 38; *Bentl. and. Trim., t.* 275.

Hab.—Concan. Cultivated throughout India. The bulb and leaves.

Vernacular.—Chindár, Kánwal, Sukhdarshan (*Hind.*), Nágadavana (*Mar.*), Nágdamani (*Guz.*), Nágdaun (*Beng.*), Kesarchettu, Visha-manjili (*Tel.*), Visha-manjil (*Tam.*).

History, Uses, &c.—This plant is not mentioned by Sanskrit writers on Materia Medica, but the juice of the leaves after they have been slightly roasted is a popular remedy in

Hindustan for earache. The name Sukhdarshan, "pleasant to the sight," is loosely applied to several species of Crinum in most parts of Northern India. In the Concan the leaves smeared with mustard oil or *Mutel** are warmed and bound round inflamed joints. Rheede says:—"Ex planta concisa et tosta bini sunt noduli, qui utrinque maxillæ appositi, spasmum curant cynicum." Ainslie states that the natives of Southern India bruise the leaves and mix them with a little castor oil, so forming an application which they think useful for repelling whitlows and other inflammations that come at the ends of the toes and fingers; also that the juice of the leaves is employed for earache in Upper India. Rumphius, who calls it *Radix toxicaria,* speaks highly of its virtues in curing the disease occasioned by the poisoned arrows of the Macassers in their wars; the root chewed is emetic, provided a little of the juice is swallowed. *Crinum asiaticum* is the *Man-sy-lan* of the Cochin-Chinese, and its virtues are lauded by Loureiro. (*Ainslie, Mat. Ind.,* Vol. II., p. 464.) Sir W. O'Shaughnessy remarks (*Bengal Disp.,* p. 656) that this is the only indigenous and abundant emetic plant, of which he has experience, which acts without producing griping, purging, or other unpleasant symptoms. In the *Pharmacopœia of India,* the root has been made official as an emetic, nauseant, and diaphoretic; directions for making a juice and syrup are given: the former to be given in doses of 2 to 4 fluid drachms every 20 minutes until emesis is produced, the latter in doses of 2 fluid drachms as a nauseant and emetic for children.

Description.—Caulescent or stemless; leaves linear-lanceolate, very smooth; margins entire, striated beneath, 3 to 4 feet long and 5 to 7 inches broad; scapes axillary, shorter than the leaves, a little compressed; flowers numerous, 12 to 50 in an umbel, white, almost inodorous; berries roundish, the size of a pigeon's egg. (*Bomb. Flora,* Pt. I., p. 257.) The root is bulbous, white, with a terminal stoloniferous fusiform portion issuing from the crown of the bulb; it varies greatly in size; odour narcotic and disagreeable.

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* The oil obtained from fresh rasped cocoanuts.

Microscopic structure.—The central portion of the bulb (stoloniferous fusiform portion) consists of a parenchyma made up of polyhedral cells containing a little granular matter and some needle-shaped crystals; it is traversed by numerous bundles of jointed and spiral vessels; surrounding the central portion is a solid cortical layer less vascular than the central column; from both of these spring the subterraneous white bases of the leaves which form the upper part of the bulb.

Crinum zeylanicum, *Linn., Wight Ic.,* 2019—20; *Rheede, Hort. Mal. xi., t.* 39; *Bot. Mag.,* 1171, 2217, 2292, and 2466, is a very variable plant, plentiful in most parts of India. It is the *Tulipa javanica* of Rumphius. Rheede states that the crushed and toasted bulb is applied to piles and abscesses to cause suppuration, and that if given to dogs it causes their teeth to fall out. According to Loureiro, it has the properties of squills. In the Concan a slice of the bulb is used for blistering cattle, and the roasted bulb is used as a rubefacient in rheumatism. The plant is called Sukhdarshan in Bengal and Hindustan, and Gadanikand or Gadámbhikánda in Marathi. It has not been identified with any of the plants mentioned by Sanskrit writers. Its properties are similar to those of *C. asiaticum.*

Description.—Root a spherical, tunicated bulb; leaves numerous, radical, lanceolate, waved, smooth, tapering slowly from within a few inches of the base to rather a broad and obtuse point; margins scabrous with minute cartilaginous teeth, length 1 to 3 feet; scapes from the axils of the decayed leaves, somewhat compressed, 1 to 2 feet long; umbels with about 10 flowers; spathes two, of an ovate conic form, with many soft filaments among the flowers; flowers sessile, large, tube green, border very pale rose, almost white, faintly fragrant; corol tube declinate, cylindric, obscurely 3-sided, about 4 inches long; border campanulate, horizontal, segments lanceolar, with rather soft subulate points; length 3 to 4 inches; filaments six, inserted in the mouth of the tube, declinate; apices sharp and always erect; anthers falcate, incumbent and tremulous, pale yellowish-grey; germ inferior, oblong, 3-celled with several ovula in each, attached in two vertical rows to the two lobes of the thick fleshy receptacles; style filiform, declinate, projecting beyond the stamina; stigma small, 3-toothed; pericarpium a soft somewhat fleshy perishable envelope which covers one, two, or three large fleshy bulbiform seeds.

LILIACEÆ.

ALOE PERRYI, *Baker.*

Fig.—*Bot. Mag.*, 6596. Socotrine Aloe (*Eng.*).

Hab.—Socotra.

ALOE ABYSSINICA, *Lam.*

Fig.—*Baker in Linn. Journal, xviii.*, 174. Jaferabad Aloe (*Eng.*).

Hab.—Africa, Coasts of India.

ALOE VERA, *Linn.*

Fig.—*Flora Græca., t.* 341, *cop. in Steph. & Ch., t.* 109, and *Woodville*, vol. v.; *Nees, t.* 50. Common or Barbadoes Aloe, (*Eng.*).

Hab.—Africa, Arabia, India. The dried juice.

Vernacular.—Ghikunvár, Kumári (*Hind.*), Ghirta-kunvár, Komári (*Beng.*), Kora-kánda, Koraphád (*Mar.*), Kumára, Kuvára (*Guz.*), Shottu-katrázhai, Kumári (*Tam.*), Kalabanda (*Tel.*), Kátruvazha (*Mal.*), Lola-sara (*Can.*).

The drug Aloes.—Ilva, Yalva (*Hind.*), Moshabbar (*Beng.*), Eilya, Kála-bol (*Mar.*), Kariya-polam, Irakta-polam (*Tam.*), Musham-baram (*Tel.*), Chenna-náyakam (*Mal.*), Elio (*Guz.*), Musambra (*Can.*).

History, Uses, &c.—The common Aloe (Grihakanya), if not a native of India, must have run wild in the country from a very remote period, as the Sanskrit synonyms do not in any way indicate a foreign origin. By the names Ghrita-kumári, Kumári, Mátá, Kanyaka, Taruni, Sávari, the plant is compared to a beautiful girl or to the virgin Durga. Many synonyms are descriptive, such as Dirgha-pattrika "long-leaved," Sthaleruha "growing in dry ground," Mridu "soft," Bahu-pattra "having numerous leaves," Kantaka-pattra "having prickly leaves," Vipula-srava "juicy," Mandalá "scimitar-like," Atipicchila "very slimy," &c. The juice is considered to be cathartic, cold, and useful for removing disease of the spleen, swellings, phlegm, carbuncles, and blood and skin diseases. The Hindus appear not to have been acquainted with the drug until it was introduced into India by the Arabs; when this took place it is very difficult to decide, but it must have been at a very remote period if we are to believe Dioscorides, who says "the Aloe grows plentifully in India, whence also the juice is brought to us, also in Arabia and Asia (minor), and in certain maritime districts and islands, as Andros." On the other hand, Sanskrit writers do not mention the drug; possibly the orthodox Hindu physicians of those days may have regarded it as an impure compound prepared by foreigners. *Elwa* or *Ailwa*, the Hindi name for aloes, appears to be cognate to the Greek ἀλοη. Aloes appears to have been first manufactured by Arabs or Abyssinians, through whom the Greeks obtained a knowledge of it. Hippocrates and Theophrastus do not mention it, but Dioscorides and Pliny were evidently well acquainted with the drug and its uses, and also with the plant, which it appears had been introduced into the Cyclades. Abu Hanifeh in the 9th century describes aloes (Sabir) and the plant from which it is obtained as having a yellow flower and very thick leaves which are crushed and thrown into the presses, and trodden with the feet until their juice flows, when it is left until it thickens, and is then put into leathern bags and exposed to the sun until it dries. This method of preparation fully accounts for the inferiority of Arabian aloes. All the Arabian and Persian writers agree in stating that the best aloes is prepared in Socotra, and many relate that Alexander, on the recommendation of Aristotle, took possession of the island on that account and settled a colony of

Greeks there to cultivate the plant more carefully. Schweinfurth has observed an apparently Semitic type amongst the hill tribes of the island, which he thinks may be traced to a Greek source; characterised by small head, with long nose and thick lips, straight hair, and lean limbs. In some hieroglyphics on the Kadhab plain he has also traced combinations of Greek characters. The Socotrian women are reputed to be sorceresses of the most dangerous kind, who by the aid of a magic cup steal away the liver and lights of those against whom they bear malice; a horrid suggestion to account for the excellence of their aloes. This story seems to support the derivation of the names Socotra and Socotrine suggested by Mr. Mowat in '*Alphita,*' p. 67. He connects them with the Greek *συκωτός* = Lat. ficatus = It. fegato. This word 'originally seems to have denoted the liver of a goose fattened on figs,' and the word socotrinum or succotrinum applied to aloes would therefore be the equivalent of epaticum. (Cf. *Trans. Rl. Soc. Edinburgh,* xxxi., p. 444.) Burton says: "The aloe, according to Burckhardt, is planted in graveyards as a lesson of patience: it is also slung, like the dried crocodile, over house-doors to prevent evil spirits entering: 'thus hung without earth and water,' says Lane (*Mod. Egypt,* Chapt. XI.), 'it will live for several years and even blossom. Hence (?) it is called *Sabr,* which signifies patience.' But *Sibr* as well as *Sabr* (a root) means 'long-sufferance.' I hold the practice to be one of the many Inner African superstitions. The wild Gallas to the present day plant aloes on graves, and suppose that when the plant sprouts the deceased has been admitted to the gardens of *Wák,* the Creator." (*Arab. Nights,* i., 138.) Mahometan physicians describe aloes as aperient, deobstruent, depurative, anthelmintic and tonic; as a collyrium they consider that it strengthens the sight and removes styes of the lids; it is often applied for the dispersion of swellings and the promotion of granulations. They direct it to be purified in the following manner:—Take Socotrine Aloes 1 lb., powder and sift, then take wormwood, Jatamási, Chiretta, Cinnamon, Cassia, wood of the Balsam tree, Herba Schœnanthi, Asárum, Mastich, of each 3 dirhems, boil in 2 lbs. of water down to one pound and strain. Put the aloes into a mortar, rub it down with part of the above decoction and strain, repeat the process with the remainder of the decoction and any aloes remaining on the strainer, let the strained liquors subside, draw off the supernatant fluid, mix the aloes with 3 dirhems of saffron and preserve for use. In Anthony Colin's translation of Clusius, the following notice of aloes by Garcia d'Orta occurs:—" Les Indiens s'en servent en leurs collyres et aux medicamens purgatifs comme aussi és playes, lesquelles ils veulent remplir de chair pour lequel usage ils ont le plus souvent dedans leur boutiques un medicament composé de myrrhe ét aloes apellé par eux Mocebar (mussabar). J'ai vue un medecin du grand Sultan Badur Roy de Cambaya lequel usoit de l'herbe d'aloes pour medicament familier en ceste façon. Il faisoit cuire avec du sel les fueilles de l'herbe couppées, de telle decoction il en faisoit prendre huict onces lesquelles faisoyent vuider le ventre fort benignement et sans aucune extorsion quatre ou cinq fois. En ceste ville de Goa ils donnent en breuvage a ceux qui ont des ulceres aux reins ou en la vescie de l'aloe bien pulverisé et meslé avec du laict qui a si heureux succes et profit que les malades en sont incontinent gueris. Ils s'en servent aux Indes pour faire meurir les flegmons." In the same work there is a prescription for the use of fresh aloe leaves by Christophe de la Coste. Take of aloe leaves sliced 3 ozs., salt 3 drms., heat to boiling over a gentle fire, strain and add 1 oz. of sugar. Let the liquid cool, and take it cold early in the morning. The patient should be directed to keep moving about to promote the action of the medicine, and four hours after taking it some chicken broth may be given. The leaves and flower stalks of the aloe are pickled by Banians of Guzerat after having been soaked in salt and water, and it is a general practice among Hindus to give a little of the juice of the plant with honey in a golden spoon to new-born children; it is supposed to hasten the expulsion of the meconium. The dose must be administered by the father of the child, or by the nearest male relative in the absence of the father.

Prof. Bayley Balfour, who visited Socotra on a botanical expedition in 1880, has given the following account of the manner in which aloes is prepared:—"The gum is known as *tâyef* by the natives. The collector scrapes a slight hollow on the surface of the ground in the vicinity of an aloe plant, into which he depresses the centre of a small portion of goat-skin spread over the ground. The leaves of the aloe are cut and laid in a circle on the skin, with the cut ends projecting over the central hollow. Two or three layers are arranged. The juice, which is of a pale amber colour, with a slight mawkish odour and taste, trickles from the leaves upon the goat-skin. After about three hours the leaves are exhausted; the skin containing the juice is then removed from beneath them, and the juice is transferred to a bag made of skin. Only the older leaves are used. The juice thus collected is of a thin watery character, and is known as *tâyef rhiho,* or watery aloes. In this condition it is exported to Muscat and Arabia, and sells for three dollars the skin of 30 lbs. By keeping, however, the aloes changes in character. After a month the juice, by loss of water, becomes denser and more viscid; it is then known as *tâyef gesheeshah,* and is more valuble, a skin of 30 lbs. fetching five dollars; whilst in about fifteen days more—that is, about six weeks after collection—it gets into a tolerably hard solid mass, and is then *tâyef kasahul,* and is worth seven dollars a skin of 30 lbs. In this last condition it is commonly exported. (*Trans. Rl. Soc. of Edinburgh,* xxxi., *Introductory Chapter,* p. xxxviii.).

Description.—Socotrine aloes is imported into Bombay *viâ* Zanzibar and the Red Sea ports. It is packed in skins, the packages varying much in size and shape, and often containing a large proportion of rubbish, such as pieces of hide, stones, &c. In Bombay the skins are opened, and the aloes repacked in boxes for exportation to Europe. The best Socotrine aloes is of a golden-brown colour, hard externally, soft internally: the odour is aromatic and peculiar; when powdered or in thin fragments it is orange-brown, sometimes it is almost fluid.

Jaferabad Aloes is made at Jaferabad, a town on the coast of Kathiawar, belonging to the Hubshis of Jinjíra, a family of African origin. The drug in mass is black; it has a glassy fracture; thin pieces are yellowish-brown and translucent; the powder is of a dull yellow; the odour powerfully aloetic, with an aroma like Socotrine aloes; when brought in contact with nitric acid it does not turn red. Its reaction is then the same as Socaloin. Jaferabad Aloes is generally in the form of flat circular cakes. From Zanzibar an aloe is imported which very closely resembles Jaferabad; it gives the same reaction with nitric acid.

Yamani or **Moka Aloes,** also called Aden Aloes, is imported from Arabia, and is the kind most in use among the natives of India. It varies much in quality. It is of a black colour in mass, and somewhat porous, but thin fragments are translucent and yellowish-brown; the odour is powerfully aloetic, without the aroma of Socotrine or Jaferabad Aloes; medicinally it appears to be sufficiently active. With nitric acid it gives a deep red colour, like Barbadoes; the solution in sulphuric acid is not affected by nitric acid fumes.

Mysore aloes is made in Mysore from a plant which is probably only a variety of *A. vera.* It is called Musambra in Southern India, and is used in the arts in preparing a false gilding for decorations.

Chemical composition.—All kinds of aloes have an odour of the same character and a bitter disagreeable taste. The odour, which is often not unpleasant, especially in Socotrine Aloes, is due to a volatile oil, which the drug contains only in minute proportion. The oil is a mobile pale yellow liquid, of sp. gr. 0·863, with a boiling point of 266° to 271°C.

" Pure aloes dissolves easily in spirit of wine with the exception of a few flocculi; it is insoluble in chloroform and bisulphide of carbon, as well as in petroleum ether. The specific gravity of fine transparent fragments of aloes, dried at 100°C., and weighed in the last-named fluid at 16°C., has been found to be 1·364, showing that aloes is much more ponderous than most of the resins, which seldom have a higher specific gravity than 1·00 to 1·10. In water, aloes dissolves completely only when heated. On cooling the aqueous solution, whether concentrated or dilute, becomes turbid by the separations of resinous drops, which unite into a brown mass, the so-called resin of aloes. The clear solution, after separation of this substance, has a slightly acid reaction; it is coloured dark-brown by alkalies, black by ferric chloride, and is precipitated yellowish-grey by neutral lead acetate. Cold water dissolves about half its weight of aloes, forming an acid liquid which exhibits similar reactions. The solution of aloes in potash or ammonia is precipitated by acids, but not by water. (*Pharmacographia*, p. 686.)

The most interesting constituents of aloes are the substances known as *Aloin.* The Aloin of Jafarabad Aloes has been examined by W. A. Shenstone. About 1½ lb. of the powdered aloes was treated with enough proof-spirit to make a thin paste, and after standing for a few hours was enveloped in folds of stout calico and submitted to powerful pressure, by which means about 28 per cent. of crude Aloin was obtained. This was purified by twice crystallizing from water, then by crystallizing several times from dilute spirit, and finally by crystallizing twice or thrice from rectified spirit. Portions of the crops of crystals thus obtained were burnt with the following results:—

I. ·1104 gram of aloin which had been once crystallized from rectified spirit and dried *in vacuo* over sulphuric acid gave ·2438 gram of CO^2 and ·0561 gram of H^2O.

II. ·1380 gram of aloin which had been twice crystallized from rectified spirit and dried *in vacuo* over sulphuric acid gave ·3042 gram of CO^2 and ·0696 gram of H^2O. Corresponding to

	Carbon.	Hydrogen.	Oxygen.
I.	60·22	5·64	34·14
II............	60·11	5·60	34·29

The aloin therefore was evidently in a pure state. 1·2375 gram of pure air-dried aloin dried over sulphuric acid in a vacuum lost ·1987 gram of water, corresponding to 16·0 per cent.

When bromine water was added in excess to an aqueous solution of the aloin, a copious yellow precipitate fell. This was collected after having been in contact with excess of bromine water for an hour, washed, dried, and crystallized three times from spirit. The brominated aloin was in beautiful yellow crystals, which were rather soluble in cold alcohol, and were somewhat more stable than the aloin itself. It retained only a trace of water when dried in a vacuum over sulphuric acid, which was given off on heating to 100° C. to 110° C. ·2526 gram of the perfectly dry substance gave ·2539 gram of silver bromide, corresponding to 42·75 per cent. of bromine.

In 1875, Dr. Tilden proposed, as the result of the consideration of a number of analyses of aloins and their derivatives made by himself and others, that the aloins obtained from Barbadoes and Zanzibar aloes might be considered isomeric bodies, with the empirical formula $C^{16}H^{18}O^{7}$, which also agrees closely with his analysis of nataloin. This formula requires 59·62 per cent. of carbon and 5·59 per cent. of hydrogen. Its tribromo-derivative requires 42·93 per cent. of bromine.

It will be seen that of the numbers obtained in Mr. Shenstone's analysis, those for the hydrogen and bromine agree very closely with these, and that the proportion of carbon, though a little high, also agrees fairly well.

The water of crystallization found, 16 per cent., is rather more than the amount which would correspond to three molecules, *i.e.*, 14·3 per cent. The difficulty of getting air-dried aloin of constant composition, however, is so great that the result is not of much value.

The following comparative observations with Jafarabad aloin and Dr. Tilden's zanaloin were made:—

There is no distinguishable difference in the crystalline form of the two aloins.

Neither of them gives any change of colour in the cold when moistened with ordinary strong nitric acid; both of them are reddened by fuming nitric acid. And the Jafarabad aloin, by prolonged treatment with nitric acid, yields chrysammic, aloetic, picric, and oxalic acids as zanaloin and barbaloin do.

Jafarabad aloin, when treated with potassium chlorate in a hydrochloric acid solution, yields a chloro-body resembling that given by zanaloin, and when heated with acetic anhydride gives an acetyl compound similar to acetyl-zanaloin.

Both of them, when treated with strong sulphuric acid and potassium bichromate, give a violet coloration closely resembling that given by strychnia, but quickly fading to green.

These results seem to leave no doubt that the aloin of Jafarabad aloes is identical with that from Zanzibar aloes, though the colour of the former is distinctly a lighter shade of yellow than that of the latter.

The main points of difference among the aloins may be tabulated thus:—

1. Nataloin obtained from Natal aloes, yields only picric and oxalic acids by treatment with nitric acid. Is not reddened, even on heating, by that re-agent.

2. Barbaloins yield chrysammic, aloetic, picric, and oxalic acids by treatment with nitric acid. They may be divided into—

(A) *a*-barbaloin, obtained from Barbadoes or Moka aloes. Is reddened in the cold by ordinary strong nitric acid.

(B) *b*-barbaloin, obtained from Socotrine, Zanzibar, and Jafarabad aloes. Is not coloured by cold nitric acid, but gives an orange-red coloration when heated with it, and also gives a coloration in the cold with fuming nitric acid. (*Shenstone in Phar. Journ.*, Dec., 1882.)

Commerce.—Bombay is the centre of the Aloes trade in the East and imports from Arabia (and Socotra through Aden) yearly about 1,500 cwts. of the drug valued at about Rs. 30,000. Of this quantity from 300 to 400 cwts. (chiefly Socotrine) are re-exported to Europe, and 200 to 300 cwts. to Eastern ports, the remainder being consumed in India.

Madras and Sind occasionally export small quantities of Indian aloes to Eastern ports.

The Indian varieties of the drug are manufactured in Kattiawar (Jafarabad) and in Mysore, and are consumed locally. It is impossible to form a correct estimate of the quantity produced, but we do not think it can be very great, as the Arabian aloes is the drug met with in most parts of India.

URGINEA INDICA, *Kunth.*

Fig.—*Wight Ic., t.* 2063. Indian Squill (*Eng.*).

Hab.—India. The bulb.

Vernacular.—Kándá, Jangli-piyaj (*Hind., Beng.*), Kol-kándá, Kochinda (*Mar.*), Nari-vengayam (*Tam.*), Nakka-vulli-gadda (*Tel.*), Kattulli (*Mal.*), Adavi-irulli (*Can.*), Jangli-kánda (*Guz.*).

History, Uses, &c.—This plant is not mentioned in the Nighantas, but the bulb is used in the preparation of Chándi-bhasma or "ashes of silver" which is used medicinally by the Hindus. Indian Mahometan writers consider the Indian squill to be identical in medicinal properties with the squill of Europe, which was used by the Greeks, who prescribed it combined with vinegar and honey much as we do at the present time (*Diosc.* ii., 162); they prescribe it in paralytic affections, also as an expectorant, digestive, diuretic, and deobstruent in many diseases, more especially in asthma, dropsy, rheumatism, calculous affections, leprosy, and skin diseases; it is also considered to be emmenagogue. In the West *Urginea Scilla* has been used in medicine from the time of Hippocrates; in Egypt it was sacred to the god Typhon and at Pelusium there was a temple dedicated to it; it was thought to have the power of driving away evil spirits, and to be symbolic of perpetual generation. The Arabs, who followed the Greeks in their estimation of its medicinal value, call it Basal-el-unsal "sea onion," or Basal-el-fár "rat's onion," and the Persians, Piyáz-i-dashti "wild onion." European physicians in India have expressed various opinions as to the medicinal activity of *Urginea indica* (confer. *Phar. of India*, p. 241), but there would appear to be no doubt that the young freshly-dried bulbs are sufficiently active, as they have been used for many years at certain of the Government Medical Store Depôts for making the various preparations of the drug.

In India the squill is always kept by native druggists in the entire state, this form being preferred by the hakims to the sliced and dried bulb. They follow the Greeks and Romans in their method of baking squills (cf. *Diosc. loc. cit.* and *Scrib. Larg. Comp.* 76).

Description.—*Urginea indica* is very abundant in sandy ground near the sea; the dirty white spike of flowers appears long before the leaves. The bulb is tunicated, consisting of fleshy coats, which enclose each other completely, generally about the size of a common onion; colour white; taste bitter and acrid.

Microscopic structure.—Each scale or modified leaf is made up of polyhedral cells covered on both sides by an epidermis provided with stomata; like a leaf, it has vascular bundles. The cells of the parenchyma are loaded with mucilage, and contain an enormous quantity of needle-shaped crystals and a few large square or oblong prisms. The presence of the former accounts for the itching of the hands experienced by those employed to slice the bulb.

Chemical composition.—The sample dried at 100° C. was examined by Dragendorff's method, with the following results:—

Petroleum ether extract	·036	per cent.
Ether extract........................	·028	„
Absolute alcohol extract.........	·152	„
Aqueous extract	77·30	„
Ash..................................	5·69	„

The petroleum ether extract was a greasy white residue and non-crystalline. The ether extract contained no alkaloidal principle; under the microscope a few imperfect four-side plates were visible.

The alcoholic extract from 9 grams of the anhydrous squills injected into a cat's stomach caused vomiting in 20 minutes, and the passage of a solid stool about an hour after the injection; no blood in vomit or stool; the cat was not otherwise affected in any way. The aqueous extract consisted chiefly of gum.

The fresh squill in slices distilled with water afforded a distillate possessing an aromatic odour, but in which no appreciable amount of oil was visible. The distillate was agitated with ether; on spontaneous evaporation of the ether, a minute trace of a white greasy residue was left, possessing an aromatic odour—applied to the skin no irritation was induced. We are indebted to Assistant Surgeon C. L. Bose for the above analysis, which was conducted in the Chemical Examiner's Laboratory, Calcutta.

Substitutes for Squills.—The bulbs of different species of Ledebouria (Scilla, *Linn.*) are sold in the Indian bazars under vernacular names which are equivalent to "small squill." *L. hyacinthoides* is said by Ainslie to be used by farriers in Southern India for the relief of strangury and in fevers occurring in horses. (*Mat. Ind.*, i., p. 402.) From Dr. Hové we learn that the bulbs were used in the Colaba Hospital, Bombay, by Mr. Guise, the Surgeon of the island in 1787, instead of squills. For many years they were issued from the Bombay Medical Stores in lieu of squills (*Indian Journ. of Med. Phys. Sci.*, Jan. 18th, 1838, p. 9), but of late years *Urginea indica* has been in use; both appear to be equally satisfactory substitutes for squills.

L. hyacinthoides has a scaly bulb, about the size and shape of a small pear, composed of very smooth and fleshy scales, which are so imbricated that they might be mistaken for entire coats if not carefully examined; the exterior scales are dry and whitey-brown, the interior fleshy and cream-coloured; the odour is nauseous; the taste bitter and acrid.

Bulbs, the size of a large nut, purchased by one of us in the Bombay shops, which we have cultivated, proved to be those of *Ledebouria maculata*, Dalz. The leaves were obovate, glabrous, wedge-shaped, attenuated into the petiole, purple spotted, and never bearing bulbs; scapes bearing a many-flowered raceme of small asphodel-like flowers having a delicate purplish-blue tinge, and a bloom like that of the Auricula. This plant is very common in the Concan, and comes into blossom in June, immediately after the first fall of rain.

ASPHODELUS FISTULOSUS, *Linn.*

Fig.—*Wight Ic., t.* 2062; *Sibth. Fl. Gr., t.* 335.

Hab.—Northern India, Afghanistan. The seeds.

Vernacular.—Piazi, Bokhat, Binghar-bij (*Punjab, Sind*).

History, Uses, &c.—The plant has a reputation in Sind and the Punjab as a diuretic, and the seeds are sold in the shops; it is very abundant in cultivated ground about Jhelam and in Southern Afghanistan. (Murray.) Sibthorp describes it as common near Athens. In Northern India and Afghanistan it is eaten as a vegetable. Hesiod, who wrote about 800 B. C., when he enjoins temperance and simplicity of living in his "Works and Days," says (ver. 30):—

νήπιοι. ὀυδὲ ἴσασιν, ὅσῳ πλέον ἥμισυ παντὸς
οὐδ' ὅσον ἐν μαλάχῃ τε καὶ ἀσφοδέλῳμέγ ὄνειάρ.

How much is the half better than the whole! How great a blessing is there in Mallows and Asphodel! Theophrastus, in his *History of Plants* (vii., 11), tells us that Asphodel roots were eaten by the Greeks, and an Asphodel is described by Dioscorides* as a medicinal plant having diuretic and deobstruent properties when given internally, and being useful as an external application to ulcers and inflamed parts, &c. The Romans called the same plant '*Hastula regia,*' or king's spear, and used it as a remedy for *morbus regius* or ἴκτερος (cf. *Hipp. de Morbis*, ii., 35). Arabic and Persian writers on Materia Medica describe an Asphodel with white flowers under the name of Khunsa (خنثي), the same, or a very similar plant, is called

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* Diosc., ii., 159. The Anthericon of Theophrastus was probably the Yellow Asphodel. In Western and Southern India *Anthericum tuberosum*, Roxb., is in common use as a vegetable, boiling appears to remove the acrid properties of these plants.

Ashrásh, or Saresh in Persian; Ibn Sina says اصل الخنثى هو الاشراش, To this plant they attribute the same properties as Dioscorides does to Asphodel (confer. *Tuhfat-el-muminín*, article خنثي). The root of *Asphodelus bulbosus* under the name of Teinisse is used in the East to prepare mucilage and adulterate salep.

Description.—Annual, stem naked, ramous; leaves erect, linear, cylindric, fistulous, tapering to a point; scape erect, branched; flowers small, white with a brownish line running along the centre; filaments ciliate, contracted; corol 6-partite; stigma capitate; ovary 3-celled.

GLORIOSA SUPERBA, *Linn.*

Fig.—*Bot. Reg., t.* 77; *Wight Ic., t.* 2047; *Rheede, Hort. Mal. vii., t.* 57. Superb Lily (*Eng.*).

Hab.—Throughout India. The tubers.

Vernacular.—Kalihári, Lánguli (*Hind.*), Bisha-lánguli (*Beng.*), Nága-karia, Indai, Kalávi (*Mar.*), Kalaipai-kizhangu (*Tam.*), Kalappa-gadda, Adavi-nábhi (*Tel.*), Rádágári (*Can.*), Khadya-nága, Nágli, Kalalávi (*Guz.*).

History, Uses, &c.—This very ornamental creeper is common on hedges during the rainy season, and its flowers are used by the Hindus in the worship of Siva and the Lingam. It is one of the seven minor poisons of Sanskrit writers, and is described in the *Rája Nirghanta* under the name of Kalikári. The synonyms are numerous; amongst those which are descriptive we may mention Chihna-mukhi "having a spotted mouth," Sukra-pushpika "having splendid flowers," Agni-sikha "having a crest of fire," and Langalika "plough-like," in allusion to the shape of the root.

Other synonyms, such as Garbha-ghátini, Garbha-pátani, Garbha-nud, allude to the use of a paste of the root as an application to the lower part of the abdomen for the purpose of promoting labour pains. In retained placenta a paste of the root is applied to the palms of the hands and soles of the feet, whilst powdered Nigella seeds and long pepper are given internally with wine. According to the Nighantas, the root is purgative, hot, light, and pungent; it increases the secretion of bile, and is useful in leprosy, piles, colic, boils, and to expel intestinal worms. The starch obtained from the root by washing is given internally in gonorrhœa.

Moodeen Sheriff, who has experimented with the root, states that it is not so poisonous as is generally supposed; he has taken it in small quantities, gradually increasing the dose to 15 grains. There were no bad effects, but on the contrary he found his appetite improved and felt more active and stronger. He has also used it in his practice for many years, and considers it to be a tonic and stomachic in doses of from 5 to 12 grains given three times a day. In the Concan it is given to cattle to expel worms, and in Madras it is believed to be a specific against the bites of poisonous snakes, and the stings of scorpions, and is also used as an external application in parasitical skin affections. Surgeon-Major Thomson states that before being used for these purposes it is cut up into thin slices and soaked in butter-milk and salt for four or five days, and then dried, by which process its poisonous properties are supposed to be removed. He also says that the natives select those roots which are dichotomous and which they suppose to be those of the male plant, whilst single roots, which they suppose to be those of the female plant, are rejected. (*Dict. Econ. Prod. India*, iii., p. 507.)

Description.—Root tuberous, cylindrical or flattened, often 7 to 8 inches in length, and about one inch in diameter; when fully grown it consists of two tubers which unite at a right angle, one being much shorter than the other; at the point of union may be seen, on the upper surface, a circular scar marking the attachment of the stem, and on the under surface immediately beneath it another, to which a tuft of their rootlets is often attached. The tubers are covered with a brown epidermis, except at their points, which are tapering and nearly white; internally they are juicy, white, and farinaceous, and have a faint acrid odour. The taste is mucilaginous, feebly bitter, and has an acid taste. The starch granules are mostly ovoid, the vascular bundles few, consisting of spiral and jointed vessels. The root is figured by Lyon. (*Med. Juris. for India*, p. 210.)

Chemical composition.—The root has been examined by Warden, who obtained from it two resins, a tannin, and a bitter principle which he has provisionally named *Superbine.* He considers that the bitter principle is closely allied to, if not identical with that of squills. It was found to be very poisonous, 0·047 gram injected into the stomach being sufficient to kill a full-grown cat. (*Ind. Med. Gaz.*, Oct. 1880.)

Toxicology.—Ainslie and others speak of the root as violently poisonous, and it finds a place in the list of Indian poisons published by Chevers. (*Indian Ann. of Med. Sci.*, ii., p. 147.)

Dr. Buttacharjee (*Ind. Med. Gaz.*, 1872, p. 153) reports the following case:—A female, æt. 18, swallowed a quantity of the powdered root. Symptoms of poisoning appeared in half an hour, and were: retching, violent vomiting, spasms and contortions of the body, with fearful racking pain; from time to time there were short intervals of relief, followed by a recurrence of the same symptoms. Death took place in four hours. The *post-mortem* appearances were congestion of the brain and its membranes, with extravasations of blood. The lungs, liver, and kidneys were all deeply congested. The gastric mucous membrane showed signs of inflammation. The peritoneal covering of the fundus of the uterus (unimpregnated) was also found inflamed.

ASPARAGUS RACEMOSUS, *Willd.*

Fig.—*Wight, Ic.*, *t.* 1056.

Hab.—Throughout India.

ASPARAGUS SARMENTOSUS, *Willd.*

Fig.—*Rheede, Hort. Mal. x., t.* 10.

Hab.—Upper India, Concan, and Deccan. The roots.

Vernacular.—Satáwar, Satávari (*Hind., Guz., Mar.*), Satamuli (*Beng.*), Shatávali (*Mal.*), Kilávari (*Tam.*), Shatávari (*Tel.*), Shípari (*Can.*).

History, Uses, &c.—These two plants appear to be the Satávari and Maha-satávari of the Nighantás: among the synonyms of the first, we find Dvipika, Dvipa-satru, Varaghantika, Nárâyani, and Sata-padi; the synonyms of the second are very similar, amongst them we note Bahu-puttrika, Dagdha, and Bhasma-rohâ. Both plants are considered to be heavy and cold, sweet, demulcent, galactogogue, tonic, and strengthening, and to remove bilious and rheumatic humors, blood diseases, and swellings; they are used both internally and in the preparation of several medicated oils. The tubers are candied and eaten as a sweetmeat. The fresh juice of the root is given with honey as a demulcent in bilious dyspepsia or diarrhœa (*Sárangadhara*). As an aphrodisiac, Chakradatta directs four *sérs* of the juice of the roots and four *sérs* of *ghi* to be boiled in forty *sérs* of milk, and to be flavoured with sugar or honey, and long pepper.

The chief use of the drug, however, is in the preparation of medicated oils for external application in nervous and rheumatic affections and urinary disorders. The *Nárâyana taila,* a popular remedy of this kind, contains the barks of *Ægle Marmelos, Premna integrifolia, Oroxylum indicum, Erythrina indica, Stereospermum suaveolens*, and *Pæderia fœtida;* the roots of *Withania somnifera* and *Boerhaavia repens,* the fruit of *Tribulus terrestris,* and the leaves of *Solanum xanthocarpum, Solanum indicum, Sida cordifolia* and *Sida rhombifolia,* of each twenty tolas. The whole collection is boiled in 64 *sérs* of water down to one-fourth and strained. To the strained decoction is added four *sérs* each of the juice of Satávari and prepared sesamum oil, sixteen *sérs* of cows' or goats'milk, and a paste prepared with four tolas of each of the following drugs—Fennel seeds, wood of *Cedrus Deodara*, root of *Nardostachys Jatamansi*, liquid storax, Acorus root, sandalwood, herb of *Limnanthemum cristatum*, costus, cardamoms, leaves of *Desmodium gangeticum*, of *Uraria lagopoides*, of *Phaseolus trilobus*, and of *Teramnus labialis*, roots of *Withania somnifera*, *Vanda Roxburghii*, and *Boerhaavia repens*, rock salt. The whole is then reboiled and perfumed. (*Chakradatta.*)

Description.—Both plants are scandent woody shrubs, the roots of which consist of numerous fusiform, smooth, perennial tubers, 6 to 8 inches long and ¼ inch in diameter. They have a light brown, silicious external covering which is removed before they are used. The substance of the fresh tubers is mucilaginous, white, and somewhat translucent, and has a mawkish, insipid flavour.

Chemical composition.—The powdered roots were separated into—

Water extract	52·43
Crude fibre	33·65
Moisture	9·46
Ash	4·46
	100·00

The amount of saccharine matter, estimated as glucose, in the water extract was 7·14 per cent. Some of this extract was boiled and filtered and evaporated down to a soft consistence and allowed to remain for three months under a bell jar. At the end of that time no crystalline substances had formed, indicating the probable absence of crystalline sugars, mannite, and asparagin.

Asparagus adscendens, *Roxb.*, is an herbaceous, erect, thorny plant growing in Rohilkhand, Guzerat, and other parts of Central India. Though not mentioned in the Nighantás, the tuberous root, decorticated and dried, is in general use in India under the names of Suffed-músli, Dholi-musali, or Ujli-músali. The commercial article consists of shrivelled decorticated tubers, from 2 to 2½ inches long, the largest being about ¼ inch in diameter; they are of an ivory white colour, often twisted, hard and brittle; adhering to some of the pieces may be seen portions of a yellowish epidermis; when soaked in water they swell up and become spindle-shaped, the thickest part being about the size of a lead pencil. Under the microscope these tubers present a delicate cellular structure, the cells of which contain nothing but a little fine granular matter and mucilage; this surrounds a central vascular column, the middle part of which is entirely occupied by jointed vessels, the outer portions consisting of scalariform; the portions of adherent epidermis already mentioned are silicious. Suffed-músli has an agreeable mucilaginous taste; we have used it largely as an article of diet; it is far nicer than Salep, and is generally relished by Europeans. To prepare it, take 200 grs. of the powder, 200 grs. of sugar, pour upon them slowly a large teacupful of boiling milk, stirring constantly all the time. The best white picked roots are worth Rs. 25 per maund of 37½ lbs.

Chemical composition.—The powdered roots were examined as those of the previous article, and were found to contain—

Water extract	77·55
Cellulose	12·85
Moisture	6·00
Ash	3·60
	100·00

The water extract was a thick mucilaginous liquid which threw out white flocks of albuminous matter when boiled, and was not affected by Fehling's solution. The portion of the root insoluble in water consisted of almost pure cellulose.

ASPARAGUS OFFICINALIS, *Linn.*

Fig.—*Eng. Bot.*, 339; *Blackw.*, *t.* 332; Sperage, Asparagus (*Eng.*), Asperge (*Fr.*).

Hab.—Europe, Southern Russia, Turkey. Cultivated in Persia and Northern India. The plant, root, and ripe fruit.

Vernacular.—The fruit, Haliyun (*Ind. Bazars*).

History, Uses, &c.—Asparagus was well known to the Greeks and Romans both wild and in a cultivated state. Hippocrates mentions it in his treatise on diet, and in his treatise on the Diseases of Women he says that the berries taken in wine promote conception. Dioscorides and Pliny describe its medicinal properties, and Cato (*De re Rust.* c. 161) gives full directions concerning its cultivation. The ancients considered it to be a wholesome vegetable, dispelling flatulency and acting as a mild aperient, diuretic and aphrodisiac. They administered the root in wine for calculous affections and pains in the uterus, and also considered it beneficial in elephantiasis. Ibn Sina calls it هليون *haliún* and quotes Galen's opinion of its medicinal value.

The Western Arabs call it *Isferáj*; in Persia it is known as *Márchubeh* and *Márgiyeh* "snake wort," from its being considered to be an antidote for snake poison. Wild asparagus, the *A. tenuifolius* of Linnæus, was known to the Romans as Corruda, a name still current in the south of France, where the plant is valued for its medicinal properties up to the present time. Broussais considered asparagus to be a sedative in palpitation of the heart, and it is still used in France as a diuretic in cardiac dropsy and chronic gout. The young shoots when eaten as a vegetable are well known to communicate a peculiar and offensive odour to the urine, a syrup for medicinal use is prepared with their juice, 100 parts after clarification being added to 190 parts of sugar.

Some physicians consider asparagus to be useless as a diuretic and even injurious to the bladder, but as far as our experience goes it has no ill-effects when taken daily for a considerable time. Indian Mahometan writers on medicine merely retail what the ancients have said about this plant; they usually prescribe the dried berries which are to be found in the bazars of all large towns.

Description.—The root consists of a short horizontal rhizome about ¾ of an inch thick, the upper side is scaly and marked by stem-scars, below it gives off numerous long, whitish, nearly simple roots, which on drying become much wrinkled. It has hardly any odour and a mawkish sweet taste. The berries are scarlet, about the size of a pea, 3-celled, one or two of the cells often abortive, seeds 1-2 in each cell, globose, with a horny albumen, and a transverse embryo, far out of the centre.

Chemical composition.—Examined by Dulong, the root was found to contain yellow resin, sugar, gum, albumin, chlorides, phosphates, malates, and acetates. Vanquelin and Robiquet (1805) discovered *asparagin* in the shoots, a substance which has since been found in many other plants. Reinsch (1870) found in the berries much grape sugar and *spargancin*, an orange-red sublimable colouring matter soluble in ether and crystallizing in scales. The seeds contain a fixed oil, an aromatic resin, crystallizable sugar, and a crystalline bitter principle, *spargin*. Asparagin, $C^4H^8N^2O^3H^2O$, forms colourless, inodorous, and nearly tasteless crystals, which are insoluble in strong alcohol and ether. It unites with both acids and alkalies, and when boiled with them is converted into *aspartic acid*, $C^4H^7NO^4$, and ammonia. Nitrous acid converts it into malic acid, $C^4H^6O^4$, water and nitrogen. For further information concerning Asparagin, the reader is referred to *Watts' Dict. of Chem.*, 2nd Ed., I., 325.

The mean of four analyses quoted by König gives the following as the proximate composition:—

Water	93·75	per cent.
Albuminoids	1·79	„
Fat	·25	„
Sugar	·37	„
Nitrogen free extractive	2·26	„
Cellulose	1·04	„
Ash	·54	„

The anhydrous plant contained 4·61 per cent. nitrogen, and 42·08 per cent. carbohydrates.

ALLIUM SATIVUM, *Linn.*

Fig.—*Bentl. and Trim.*, 280; *Woodville, t.* 256; *Reich. Ic. Fl. Germ. x., t.* 488. Garlic (*Eng.*), Ail (*Fr.*).

Hab.—Central Asia. Cultivated throughout India. The bulbs.

Vernacular.—Lasan, Lahsan (*Hind.*), Rasun, Lashun (*Beng.*), Vallai-púndu (*Tam.*), Vellulli (*Tel.*), Beliuli (*Can.*), Lasuna (*Mar., Guz.*).

History, Uses, &c.—Garlic is used as a condiment and medicine by the Hindus. In the *Raja Nirghanta* it is described under the name of Rasona, and bears many synonyms indicative of its properties, such as Ugra-gandha "strong smelling," Mahanshadha "panacea," Bhuta-ghna "destroying demons," Lasuna, &c. The Hindus consider it to be tonic, hot, digestive, aperient, cholagogue, and alterative; useful in cough and phlegmatic affections, fever, swellings, gonorrhœa, piles, leprosy, colic, rheumatism, and worms. During its use the diet should consist of wine, meat, and acids. A decoction of garlic in milk is given in small doses in hysteria, flatulence, sciatica, and heart disease. A compound garlic powder called *Svalparasona pinda*, which contains garlic, asafœtida, cumin, rock salt, sonchal salt, ginger, long pepper, and black pepper in equal proportions, is given in doses of about twenty grains every morning with a decoction of the root of the castor oil plant, in facial paralysis, hemiplegia, sciatica, paraplegia, and convulsive affections. Garlic juice is applied externally as a counter-irritant. As a condiment, the bulbs are largely used in the East. Garlic is the σκόροδον of the Greeks and Allium of the Romans, who appear to have used three kinds, *A. sativum*, Linn., *A. oleraceum*, Linn., and *A. ursinum*, Linn. It would be tedious to recapitulate all the medicinal properties ascribed to these plants by the ancients, as they hardly differ from those accorded to garlic by the Hindu physicians. A summary of them may be found in Pliny (xx., 23). Garlic is the ثوم (thúm) of the Arabians and سير (sír) of the Persians; their medical writers follow the ancients in mentioning three kinds, *viz.*, Bustání "garden," Bari "wild," and Kiráthi "leek-like," and in the account they give of its medicinal properties. The leek-like garlic is probably meant for the bulbed leek (*Porrum capitatum*) of Hippocrates (*De Morb. Mul.*, ii., 89) which was considered to have the property of opening the uterus when contracted, and De Gubernatis states that in Sicily garlic is still placed upon the beds of parturient women. He also notices the wide-spread belief in the protective power of garlic against evil influences among the Hindus, Scandinavians, Greeks, and Germans, as shown by passages in Sanskrit works, in the Songs of Sigurdrifa and Helgi, the Volsungasaga and Hippocrates. In Bologna, at the present day, it is purchased by every one on the feast of Saint John as a guarantee against poverty during the year, whence the proverb:

> Chi 'n compra i ai al de d'San Zvan,
> É povret tot gl'an. (*Myth. des Plant.*, ii., 7.)

Garlic is still used medicinally to some extent on the Continent of Europe and in America, but in England it is hardly ever prescribed. A syrup of garlic was formerly official in the Dublin Pharmacopœia, and was given in doses of two drachms in moist asthma. As a condiment, it enters into the composition of most sauces. After intense fatigue a clove of garlic slowly chewed, and swallowed, acts as a very powerful restorative.

Description.—Garlic is a sub-globular compound bulb, surrounded by a few dry membranaceous scales, which cover the remnant of the upright stem and the 5 to 8 small bulbs or cloves arranged in a circle around its base. These bulblets are oblong in outline, compressed from both sides, wedge-shaped toward the stem, and rounded upon the back. They consist of a few thick fleshy scales and a short fleshy axis. Garlic has a peculiar pungent and disagreeable odour, and an acrid, burning taste. It is used in the fresh state only.

Chemical composition.—Besides cellular tissue, garlic contains between 50 and 60 per cent. of water, 35 per cent. of mucilage, some albumen, sugar, starch, and about ¼ per cent. of volatile oil, to which its odour and taste are due. W. Dahlen gives the following as the percentage proximate composition:—

Water	64·66
Albuminoids	6·76
Fat	·06
Sugar	trace.
Nitrogen free extractive	26·31
Cellulose	·77
Ash	1·44

Anhydrous garlic contained nitrogen 3·06 per cent. and carbohydrates 74·45 per cent. (*Landw. Jahrbücher*, 1874.)

In its crude state *oil of garlic* is of a dark brown-yellow colour, heavier than water, of a very repulsive taste, and consists of oxide and sulphides of allyl. The rectified oil consists mainly of the sulphide, $(C^3H^5)^2S$, is colourless, lighter than water, and may be obtained artificially by treating an alcoholic solution of potassium sulphide with allyl iodide. It dissolves easily in alcohol and ether, and sparingly in water; with nitrate of silver, mercuric chloride, and other metallic salts it forms crystalline compounds. Garlic, macerated in water or vinegar, yields its virtues to these liquids. (*Stillé and Maisch.*)

Allylic sulphide can also be obtained from the herb and seeds of *Thlaspi arvense*, together with sulphocyanide of allyl, and oil of mustard. The leaves of *Sisymbrium Alliaria* yield oil of garlic, and the seeds oil of mustard. A mixture of these two oils is also yielded by *Capsella Bursa-pastoris*, *Raphanus Raphanistrum*, and *Nasturtium*. In some cases the oils do not exist ready formed; for example, the seeds of *Thlaspi arvense* emit no odour when bruised, and they must be macerated in water some time before distillation. (*Watts.*)

Commerce.—Garlic is cultivated all over India, and is on sale in every grocer's shop. No statistics are available as to the quantity produced in India, which must be very large. Value, about Rs. 8 per cwt.

ALLIUM MACLEANI, *Baker.*

Fig.—*Bot. Mag.*, 6707; *Hanbury, Sci. Papers*, p. 156—57. Royal Salep (*Eng.*).

Hab.—Persia, abundant in the Badghis. The bulbs scalded and dried.

Vernacular.—Bádshah or Pádshah Sálab (*Ind. Bazars*).

History, Uses, &c.—This bulb appears to be the second kind of Sálab mentioned by Mir Muhamad Husain in the *Makhzan*, which he describes as black and shining. It is brought to India by Afghans in small parcels along with the dried fruit and other articles for which they find a sale in the Indian Bazars. A solitary specimen of the dried bulb was sent to Hanbury by Dr. J. E. Stocks, but did not at the time attract attention. In 1858, however, a parcel containing about 100 lbs. having been offered for sale in the London market, Hanbury recognised the drug as identical with the bulb he had received from Dr. Stocks as *Badshah Saleb*, and described it in the *N. Repert. f. Pharm.*, vii., 271. In India the drug is regarded as a kind of salep, and is used as such, but, as Hanbury remarks, its bitterish somewhat acrid taste quite unfits it as a substitute for salep in Europe. The botanical source of the drug was discovered by Dr. Aitchison in 1888.

Description.—Royal salep consists of dried bulbs whose dimensions from base to apex vary from 1⅛ to 2 inches. The largest specimens weigh 730 grains: the average weight, taking twenty bulbs, was found to be 337 grains. Allowing for considerable irregularity occasioned by drying, the form of the dried bulbs may be described as usually nearly spherical, sometimes ovoid or nearly oblong, always pointed at the upper extremity, and having at the lower either a depressed cicatrix, or frequently a large, white, elevated, scar-like mark. Their surface is striated longitudinally, besides which there is mostly one broad and deep furrow running in the same direction. They are usually translucent, and from yellowish-brown to deep purple in colour. In substance the bulbs are dense and horny. After several hours' maceration in water, they become soft, opaque, and of a slaty or purplish hue, and increase greatly in volume, regaining their natural size and form. If, in this state, a bulb be cut longitudinally into two equal portions, it will be seen to consist of a single fleshy envelope or scale of excessive thickness whose edges overlap each other; this scale surrounding an elongated, flattened bud. (*Hanbury.*)

Chemical composition.—The powdered bulbs, unless kept in well-stoppered bottles, readily absorb moisture from the air. A decoction is not coloured with iodine, but is precipitated with solutions of ferric chloride and plumbic acetate. No reaction for glucose is produced by boiling with Fehling's solution. The ash contained manganese. The powdered bulbs afforded moisture 8·11 per cent., mucilage (water extract) 80·80, cellulose 7·14, and mineral matter 3·95 per cent.

Allium xiphopetalum, *Aitch. et. Baker, Trans. Linn. Soc. 2nd Ser. Botany,* Vol. III., Pt. 1, pl. xlviii., yields the Thúm-el-bari or "wild garlic" of the Arabs. It has a bulb resembling Badshah Salep in shape and appearance, but much smaller, a powerful garlic odour, and is much used for pickling by the natives. Large quantities are imported. It appears to have been sometimes confounded with Badshah Salep.

In Persia it is known as Sír-i-piazak or "onion garlic." Aitchison found it growing abundantly in the Badghis. In Bombay it is best known as Muscat garlic, from its being shipped from that port.

Allium ascalonicum, the Shallot, is called by the natives *Ek-kánda-lasun* or *Ekla-kali-lasan,* "one-clove garlic," and is used by them to cure earache, a small piece being placed in the meatus. It is also fried in butter and preserved in honey as an aphrodisiac.

Polianthes tuberosa, *Linn., Bot. Mag., t.* 1817; *Bot. Reg., t.* 63—*Vern.* Gulshabbo, Gulchérí (*Hind., Bomb.*), Raja nígandha (*Beng.*), is the Tuberose of the English, the *Fulla-pipa* of the Portuguese, and the *Amica nocturna* of Rumphius (*Amb.*, v., t. 98); it is a common garden flower, considered by the natives to be hot and dry, diuretic, and emetic. The bulbs are used as a remedy for gonorrhœa. In the Concan they are rubbed with turmeric and butter and applied to remove वत्या (Watiya), small red pimples which often trouble new-born children. They are also rubbed into a paste with the juice of Durva grass (*Cynodon dactylon*) and applied to buboes. The flower is much valued on account of its perfume, for which it is cultivated in France; it sometimes emits phosphorescent flashes of light in the night.

SANSEVIERA ZEYLANICA, *Willd.*

Fig.—*Roxb. Cor. Pl. ii., t.* 184; *Bot. Reg., t.* 160; *Rheede, Hort. Mal. xi., t.* 42. Bowstring Hemp (*Eng.*).

Hab.—Indian Peninsula. The leaves and root.

Vernacular.—Murahri, Marúl (*Hind.*), Murba, Goráchakra (*Beng.*), Márúl-kálang (*Tam.*), Isháma-koda-nár (*Tel.*), Ghan-asphan, Morvel (*Mar.*), Katu-kapel (*Mal.*), Heggurutiké (*Can.*), Murvel (*Guz.*).

History, Uses, &c.—This plant is the Múrvá of Sanskrit writers; it is mentioned by Manu (ii., 42, 44) as the source of the fibre from which the bowstrings and girdle (*maurvi*) of the Kshatriya or warrior caste of Hindus was made. In the *Uttaracharitra* the young prince Lava is represented as wearing a garland of *Múrvá* as symbolical of his position of warrior and penitent. In the Nighantás it bears numerous synonyms, such as Dévi "goddess," Moratá, Madhurasa, Madhusrava "having a sweet juice," Snighda-parni "having glossy leaves," Prithak-parni "diverse-leafed," Pílu-parni, &c., and is described as purgative, heavy, sweet, pungent, tonic, and cardiacal; a remedy for bile, heat of blood, gonorrhœa, *tridosha* (a corruption of the three humors), thirst, heart disease, itch, leprosy, fever, rheumatism, and glandular enlargements. Rheede gives the following account of its medicinel uses in Malabar:—"Folia trita et in formam boli redacta, adversus opthalmiam et oculorum suffusionem assumuntur: cum radice addito Allio ac Auripigmento in oleo *Sergelim* decocta, gonorrhæam sanant, si nempe caput cum oleo illo illinatur. Bulbus cum Sandalo citrino et butyro bubulino tritus linimentum exhibet, in nervorum contractionibus et ardoribus adhibendum. Tota denique planta oleo butyroque incocta omnium acculorum vitia emendat."

Ainslie (*Mat. Ind.*, ii., 192) remarks:—"This fleshy creeping root is, in a slight degree, warm to the taste, and of a not unpleasant odour; and is prescribed, by the native practitioners, in the form of an electuary, in consumptive complaints and coughs of long standing, to the quantity of a small teaspoonful twice daily. The juice of the tender shoots of the plants they administer to children to clear their throats of viscid phlegm. The plant is cultivated in great abundance at Cumbum, and on the Vursenand Mountains in the Dindigul District."

Description.—Root perennial, stoloniferous. Stolones as thick as the little finger, running under the ground, inserted in sheathing scales. Stem none. Leaves radical, from four to eight, the exterior ones shortest, spreading most, and considerably broader, the interior ones nearly erect, from 1—4 feet long, semicylindric, grooved on the upper side, each ending in a round, tapering, sharp point; they are all coloured with deeper and lighter green, and somewhat striated, but otherwise are smooth. Scapes issuing from the centre of the leaves, from 1—2 feet long, including the raceme, or flower-bearing part, erect, round, smooth, about as thick as a small ratan, between the raceme and the base these are at regular distances, four or five pointed, alternate sheaths. Racemes erect, about as long as, or longer than, the scape below the flowers, striated, smooth. Flowers middle-sized, greenish-white, erect, collected in fascicles of from 4 to 6, on little, regularly distant tuberosities of the rachis. Bracts small, membranaceous. Pedicels clubbed, short, ascending, one-flowered. Calyx none. Coralla one-petalled, not in the least wrinkled, funnel-shaped, half six-cleft; divisions nearly linear. Filaments length of the divisions of the coralla, and inserted into the base. Anthers linear-oblong, incumbent, half two-cleft. Germ 3-lobed, 3-celled, each containing a single ovule, attached to the axis. Style length of the stamens. Stigma 3-sided, clubbed, entire. Berries 1—3, slightly united; when single, globular, fleshy, orange-coloured, smooth, the size of a pea, one-seeded. Seed globubar. Embryo simple, lodged near the base of the perisperm on the outside. (*Roxburgh.*)

Chemical composition.—An alcoholic extract from the fresh roots was mixed with water acidulated with sulphuric acid, and agitated with petroleum ether, ether, then rendered alkaline and reagitated with ether.

The petroleum ether left on spontaneous evaporation a viscid, slightly greenish-yellow residue, with a ginger-like odour, similar to that of the fresh roots. The extract was partly soluble in absolute alcohol, the solution possessing a pungent ginger-like taste and acid reaction. The portion insoluble in alcohol was white and had the properties of a wax.

The acid ether extract had a fragrant vanilla-like odour and was yellowish-green. It contained salicylic acid, a yellow neutral bitter resin, a greenish acid resin, traces of an alkaloid, and a white neutral principle, slightly soluble in cold absolute alcohol: the nature of this principle was not ascertained. The alkaline ether extract contained a crystallizable white alkaloid, affording a slight yellowish-red colour with Fröhde's reagent in the cold, changing to blue on warming; and, with nitric acid, a faint yellow coloration. We provisionally name this alkaloid *Sansevierine.*

HERMODACTYLUS.

Vernacular.—Surinján (*Ind. Bazars*).

History, Uses, &c.—The Hermodactyl, or "Finger of Hermes," was unknown to the early Greeks; it appears to have been first used medicinally by the Arabs or later Greek physicians; it is first mentioned by Alexandcr of Tralles, who flourished A.D. 560. (Lib. XI.) It is deserving of special notice that under the name of Surugen or Hermodactyl, Serapion comprehends the κολχικον and εφημερον of Dioscorides and the ερμοδακτυλος of Paulus Ægineta.* (*Percira*, Vol. II., Pt. I., p. 166.) Masih and other early Arabian writers describe three kinds of Hermodactyl, the white, yellow, and black; in this they are followed by most of the more recent Mahometan writers. According to Ibn Sina, the flower of the Surinján is the first flower which appears in spring in the moist valleys beneath the mountains; the leaves, he says, lie flat upon the ground, the flowers are yellow and white. Mír Muhammad Husain states in the *Makhzan* that the white is the best, and that it is not bitter; next the yellow; both may be used internally; the black, he says, is poisonous and only to be used externally. He describes the Hermodactyl plant as having leaves like a leek and a yellow flower; it is called in Persia *Shambalíd;* the black variety, he says, has red flowers.

Aitchison states that the corms of *Merendera persica* (Boiss.), a plant with pale pink or white flowers, are sold at Meshed as *Shambalid,* and are one of the kinds of Hermodactyl; they may occasionally be mixed with those of *Colchicum speciosum* (Stev.), also a common plant in the Badghis and Khorasan. The Kashmir Hermodactyls (Surinján-i-talk) are, he says, undoubtedly the corms of *Colchicum luteum* (Baker). Mahometan physicians consider the drug to be deobstruent, alterative, and aperient, especially useful in gout, rheumatism, liver, and spleen. In gout they combine it with aloes : with ginger and pepper it is lauded as an aphrodisiac; a paste made of the bitter kind with saffron and eggs is applied to rheumatic and other swellings; the powdered root is sprinkled on wounds to promote cicatrization. Two kinds of Surinján are met with in Indian shops, *bitter* and *sweet.* European physicians in India who have tried the drug consider the sweet Hermodactyl to be inert or nearly so, and the bitter to have properties similar to Colchicum. (*Phar. of India,* p. 246.)

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* Conf. Dios. iv., 82, 83. Paulus Æ. iii., 78.

Description.—Súrinján-i-shírín, or tasteless Hermodactyl. Speaking of this drug as furnished to him from India by Dr. Royle, Pereira says:—"In their general form these corms resemble those of *Colchicum autumnale.* They are flattened, cordate, hollowed out or grooved on one side, convex on the other. At their lower part (forming the base of the heart) is a mark or disc for the insertion of the root fibres. Their size varies; the specimens I have examined were from ¾ to 1¼ inch in length or height, 1 to 1½ inch in breadth, and about ½ an inch in depth. They have been deprived of their coats, are externally dirty yellow or brownish, internally white, easily broken, farinaceous, opaque, odourless, tasteless, or nearly so, and worm-eaten. They agree precisely with Hermodactyls furnished by Professor Guibourt."

"Súrinján-i-talkh, or bitter Hermodactyl. The corms of this variety are distinguished from the preceding by their bitter taste, their smaller size, and by having externally a striped or reticulated appearance. Their colour for the most part is darker; in some specimens it is blackish. One corm is ovate cordate, one inch in height or length, ¾ of an inch broad, and about ¼ inch thick, grooved or hollowed on one side, convex on the other; of a brownish-yellow colour, semi-transparent, has a horny appearance, and is marked by longitudinal stripes, indicating a laminated structure. A second is opaque, amylaceous, reticulated externally, white internally, less flattened and of a remarkable shape, the concave or hollow side of the corm being continued half an inch below the mark for the attachment of the root fibres." (*Mat. Med.*, Vol. II., Pt. I., p. 167.) Pereira's description agrees exactly with the Hermodactyls which we have examined.

Microscopic structure.—The starch grains of the tasteless Hermodactyl are large and muller-shaped, with a distinct hilum. The starch of the bitter kind is angular by compression of the cells, and appears to be broken as if by heat.

Chemical composition.—Lecanu has analysed the tasteless variety, and obtained the following result:—Starch (forming the bulk of the drug), fatty matter, yellow colouring matter, gum, supermalates of lime and potash, and chloride of potassium.

We have made comparative analyses of the Bitter Surinjan from Lahore and the Sweet Surinjan (*Merendera persica*).

	Bitter.	Sweet.
Ether extract	1·31	·69
Alcoholic extract	·54	6·23
Water extract	12·56	12·52
Starch	65·00	65·90
Cellulose	8·64	3·56
Ash	2·20	2·15
Moisture	9·75	8·95

The ether extract of the bitter Surinjan contained a resin giving a rose-red colour with sulphuric acid. The ether extract of the sweet kind consisted of fat. Both drugs contained an alkaloid giving precipitates with tannin and the usual reagents, and both contained an organic acid related to malic acid. A much larger quantity of Fehling reducing principle was present in the sweet than in the bitter drug, and this is shown in comparing the amounts of extract dissolved out by alcohol.

Commerce.—Bitter Hermodactyls are imported into India from Kashmir. The sweet kind comes from Persia. Value, Re. 1-4-0 per lb.

Substitute for the Bitter Hermodactyl.—The sliced bulb of *Narcissus Tazetta* (the true Narcissus), a plant which, when in bloom, covers like a white carpet great portions of the plains of Behbehám and valley of Sha'b-bawan in Persia, is imported into India as bitter Hermodactyl.

It may be at once detected by its larger size and tunicated structure. The taste is bitter and acrid, the substance amylaceous and very similar to that of the Hermodactyl. The starch grains are rounded and not compressed. It is used as an external application, and, according to the author of the *Makhzan*, has properties very similiar to those of Súrinjan-i-talkh. The several species of Narcissus (Gr. νάρκισσος) have a similar action. Pliny describes their emetic, purgative, maturative, and drying powers, and, referring to their soporific virtue, says, "et a narce narcissum dictum non a fabuloso puero." The Arabs give a similar account of them. Orfila's experiments upon dogs show that they act as local irritants, and also exert a depressant and paralysing effect upon the brain and whole nervous system. In man small doses are emetic; recently from 15 to 30 grains of the flowers of the common daffodil have been recommended as an emetic for children.

The following is an analyses of the corms of *Narcissus Tazetta* :—

Ether extract	·39
Alcoholic extract	1·02
Water extract	10·24
Starch	71·86
Cellulose	3·84
Ash	1·90
Moisture	10·75

The ether extract was fragrant and greasy. The alcoholic extract contained an alkaloid, bitter and acrid in taste, and a resin. Malic acid was present.

HIRANYA-TUTTHA.

This substance bears a Sanskrit name हिरण्य तुत्थ "golden collyrium," which, in the vernaculars, is converted into Haran-tuttha or Haran-tutiya. It is a medicine of great repute in Afghanistan and Northern India, and is a dark-brown dry extract, sold in small pieces, which is prepared from the corms of *Colchicum luteum* (Baker), and possibly from other species of Colchicum. In Sanskrit Tuttham or Tutthánjana is a term applied to collyria made of sulphate of copper or of the root of a plant with a yellow flower, which has by some been supposed to be a Curcuma, but which is undoubtedly *Colchicum luteum*, a plant found in the Punjab, Afghanistan, and Kashmir. C. Masson, in his narrative of an Excursion into the Hazareh Country in 1832 (*Trans. Bombay Geograph. Soc.* ii., p. 60), notices a small bulbous root, which the Afghans dug up at Bád Assiar on the banks of the Helmund, and which appeared to be a kind of Colchicum, for the purpose of preparing *Haran-tutiha*, a medicine of great repute among the Afghans. He also remarks :—" It is sold in small pieces of a dark-brown colour, and resembles a dry extract." Masson travelled through a great part of Afghanistan on foot, mixing with all classes of the people, and his experience of their manners and customs is very interesting.

SMILAX CHINA, *Linn.*

Fig.—*Kæmpfer Amæn.*, *t.* 782. China root (*Eng.*), Squine (*Fr.*).

Hab.—China.

SMILAX GLABRA, *Roxb.*

Fig.—*Seeman, Bot. of the Herald, tt.* 99—100.

Hab.—Sylhet, Garrow Hills, S. China. The tuberous roots.

Vernacular.—Chob-chini (*Ind. Bazars*), Too-fuh (*Chin.*), Sankira (*Japan*), Cay-khuc-khac (*Coch.-Chin.*), Paringai-puttai (*Tam.*), China-pagu (*Mal.*).

History, Uses, &c.—This drug was introduced into Goa from China about A.D. 1535 (*Garcia*). Previous to this date it is not noticed by any of the Mahometan physicians. The Portuguese, however, appear to have lost no time in carrying it to their factories in Persia, as it was mentioned, a few years after its introduction into Goa, by Mir Imad-ed-din Mahmud of Shiraz, Mirza Kázi of Yezd, and Mir Muhammad Háshim of Teheran. In 1669 it was described as a well-known drug in the *Tuhfat-el-muminin* under the name of Chúb-chini

(Chinese wood), in Arabic Khashab-es-sini. The author of the *Makhzan-el-Adwiya* has a long article upon its medicinal virtues. He also notices particularly the variable appearance of different samples of the drug, and directs that what is heavy, of a rosy colour, and free from knots is to be selected. He tells us that the fresh root is sometimes brought to India; some of this he planted at Moorshedabad (A. H. 1178); it produced a climbing stem with small elongated leaves, not unlike a bamboo; after a year's time he dug it up, but found that the roots had degenerated and did not retain the qualities of the China article. Chub-chini is considered by these writers to be anti-rheumatic, anti-syphilitic, aphrodisiacal, and demulcent. Loureiro says of it, "valet in quibuscunque doloribus vagis, venereis, aut rheumaticis."

Ainslie (*Mat. Ind.*, i., 70) notices its use in Southern India as an anti-syphilitic and as a remedy of much repute in a disease called *maygum vaivoo,* in which the limbs are stiff and contracted. He also states on the authority of the Abbé Rochon* that "the Chinese often eat the root instead of rice, and that it contributes to make them lusty." Roxburgh states that the *Smilax glabra,* a native of Sylhet and of the adjacent Garrow country, where it is called *Hurina-shook-China,* has large tuberous roots, not to be distinguished by the eye from China-root, and that the natives of the country use a decoction of the fresh root for the cure of sores and venereal complaints (*Flora Indica*). This plant also grows in China and affords some of the China-root of commerce. (Trimen's *Journ. of Bot.*, i., 102.)

The reported good effects of China-root on the Emperor Charles V., who was suffering from gout, acquired for the drug a great celebrity in Europe, and several works were written in praise of its virtues. But though its powers were soon found to have been greatly over-rated, it still retained some reputation as a sudorific and alterative, and was much used at the end of the 17th century in the same way as sarsaparilla. It still retains a place in some modern pharmacopœias. (*Pharmacographia.*)

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* Voyage to Madagascar and the East Indies, London, 1792.

In the East, Chub-chíní is still as highly esteemed as it ever was, and the China Trade Returns show a steady yearly increase in the quantity shipped from Southern China.

Description.—The tubers, which are formed upon the fibrous roots of the plant, are of the shape and size of an elongated kidney potato, somewhat flattened, knotty, covered with a rusty-coloured bark, sometimes smooth and shining, sometimes rough; internally their substance is of a pinkish-white colour, hard and farinaceous, insipid, mucilaginous and inodorous.

The drug is usually peeled and trimmed, and consequently is of irregular form, resembling a piece of heavy pinkish-white wood.

Microscopic structure.—The bark consists of thick-walled dark-brown brick-shaped cells, which contain bundles of crystalline needles and resinous matter. The bulk of the tuber is made up of a parenchyma, the cells of which are large, thin-walled, and loaded with starch, some pink colouring matter is also present. The starch grains are large and have a radiate hilum. The vascular system is scalariform, and is associated with porous wood cells.

Chemical composition.—The authors of the *Pharmacographia* endeavoured to obtain from the drug *Parillin,* the crystalline principle of sarsaparilla, but without success.

A proximate analysis of the air-dried drug afforded:—

Ether extract (fat)	0·33
Alcoholic extract (sugar, glucoside)	1·72
Aqueous extract (sugar, gum, &c.)	6·79
Crude fibre	13·79
Ash	1·47
Moisture	6·10
Starch (by difference)	69·80
	100·00

This root contained no alkaloid, but the alcoholic extract contained a glucoside, and a colouring matter which gave an olive-green tint with ferric chloride, but no precipitate with gelatine. With soda it afforded a deep red colour, and was precipitated from solution by neutral plumbic acetate. The sugar present abundantly reduced Fehling's test without previous inversion. The amount of ash, consisting of alkaline salts is very small.

Professor Kobert has recently separated from true sarsaparilla three glucosides, smilacin, sarsasaponin, and parillin,—these compounds differ in physiological activity,but are members of a homologous series to which has been assigned the general formula $C^{n}\ H^{2n}-{}^{8}O^{10}$.

Commerce.—From 16,000 to 17,000 peculs of 133 lbs. each are annually produced in Southern China. The greater part is consumed in China, but a very considerable portion must reach India, as the drug is to be found in every bazar throughout the country.

Smilax ovalifolia, *Roxb.*, *Rheede, Hort. Mal. vii.*, *t.* 31, Janglí-ushbah (*Hind.*), Malai-támara (*Tam.*), Konda-támara (*Tel.*), Gútwel, Gútí (*Bomb.*), Kal-támara (*Mal.*), is a climbing shrub very common in the Concans. The roots are very numerous, and have a general resemblance to sarsaparilla. A section shows a dry, suberous, brown bark; secondly, one row of 5-sided yellow cells, which are more or less wedge-shaped, their nuclei being situated towards the apices; thirdly, a range of numerous rows of ovoid cells, variable in size, with central nuclei; these extend as far as, and partially surround, the vascular zone, which consists of large vessels with generally two smaller ones in contact with them. Within the vascular zone the central portion of the root is made up of large thin-walled cells, filled with starch or red colouring matter; the latter is most abundant in young roots. The drug is not used by the natives, but in Goa it is kept in all the shops, and is the country sarsaparilla of the Portuguese.

DRACÆNA CINNABARI, *Balf. f.*

Fig.—*Balf. f. in Trans. Roy. Soc. Edin. xxxi.*, Tab. xcvi—xcvii. Dragon's blood (*Eng.*), Saug-dragon (*Fr.*).

Hab.—Socotra. The resin.

Vernacular.—The tree—Kharya (*Socotra*). The resin—Dam-khoheil, Edah (*Socotra*), Dam-el-akhwain (*Arab., Ind. Bazars*), Hira-dukhi (*Hind.*), Hira-dakhan (*Bomb.*), Kándamurgarittam (*Tam.*), Katgamurgam-nitúru (*Tel.*).

History, Uses, &c.—On the Deir-el-Bahari monument at Thebes, erected by Hatasu, a queen of the 18th dynasty, who lived about 1700 B.C., there are representations showing the commissioner of the queen going over the sea to the country of Punt and of 'To Nuter,' and bringing therefrom, amongst other things, plants bearing 'Ana,' which is shown as a gum or resin in the form of red tears on the stems of small trees with ovate-lanceolate leaves. The To Nuter of the inscription has been identified with the Sacred Islands of Pliny, and the modern archipelago, including Socotra. The gum or resin is probably dragon's blood, as that is the most remarkable substance of the kind produced on the island. The author of the Periplus of the Erythrean Sea, A.D. 54-68, mentions κιννάβαρι as a production of the island of Dioscorida, the ancient Greek name of Socotra. Dioscorides (v. 63) notices its medicinal uses under the same name, and states that it is produced in Libya (Africa). Both he and Pliny (33, 38) distinguish it from the mineral cinnabar; the latter writer states that the price of genuine cinnabaris is fifty sesterces per pound. A myth was current among the Greeks and Romans that this substance was the blood of the dragon or python crushed beneath the weight of the dying elephant, round which it had wound itself to suck the animal's blood. Rufus Ephesius and Galen notice the use of the drug for stopping hæmorrhage from wounds.

Among the Arabs it bears many names, such as Dam-el-akha-wain, Shayyán, Aidá vulg. Edá, Dam-el-tinnín, and Dam-el-thuabán "dragon's blood," Elándam, Kátir-ed-dam, and later El-kátir-el-makki vulg. Katr-makkeh. Johanna-bin-Masawiyeh, physician to the Caliph Haroun-el-Rashid, specially recommends it for strengthening the stomach and liver, and as an astringent ingredient in collyriums. On account of its use as a collyrium, the Arabs sometimes call it Dam-kuhl or simply Kuhl "collyrium."

Among the Persians it is known as Khún-i-siyáwash, and they have a myth that when Afrásiáb killed Siyáwash, this plant sprung up upon the place where his blood was shed. The author of the *Burhán*, who relates this story, also remarks that the gum is said to come from Africa. Haji Zein (1368) notices three qualities of dragon's blood, *viz.*, Chakideh 'drop,' Turábi 'earthy,' and Khashabi 'mixed with wood.' He says it is not the gum of the *bakam* (*Cæsalpinia Sappan*) as supposed by some, but of a tree growing in Africa. The author of the *Tuhfat-el-muminín* states that the plant which produces it is not known; he notices its use for painting glass. The author of the *Makhzan* (1770) merely repeats what older writers have said.

Ainslie (*Mat. Ind.*, i., 113) remarks that it is often confounded with Kino by the native doctors of Lower India. The Tamool doctors recommend a solution of it in arrack as an external application to the head and temples in cases of syncope.

Although the early European travellers in the East mention Socotra dragon's blood, Guibourt and Pereira do not notice it, and nothing exact regarding its source was known until Wellstead (*Journ. Roy. Geog. Soc.*, v. (1835), 198) described the tree, but wrongly supposed it to be *Pterocarpus Draco.*

Professor Bayley Balfour, who visited Socotra a few years ago to examine the fauna and flora of the island, was the first to give us any exact information concerning the species of Dracæna yielding dragon's blood in Socotra, and the way in which it is collected. He says, the resin exudes most abundantly immediately after the rainy season; the natives collect it by chipping it off with a knife into a small bit of skin placed against the tree; there are different qualities collected: 1*st*, the large tears, which are the best and most expensive, and are called *Edah amsal* (ايدع امثال best Edah); 2*nd*, small portions which become detached, forming powdery dragon's blood or *Edah dukkah* (ايدع دقه Edah dust); 3*rd*, an inferior kind, obtained by melting the refuse into cakes, called *Edah mikdhah* (ايدع مقدحه Edah of the ladle).

Description.—The best quality may at once be distinguished by its occurring in tears, the surface of which is covered by a dull red powder. When broken, the surface is glassy, translucent, and of a beautiful garnet colour. Imitation tears are manufactured in India from the powdery dragon's blood; they may easily be detected by their wanting the glassy fracture of the genuine article. Cake dragon's blood is also met with; it is of a dull red colour, and contains fragments of bark-wood, and other refuse.

Chemical composition.—See *Calamus Draco.*

Commerce.—The drug is imported into India through Bombay.

Zanzibar Dragon's blood is similar in appearance to that which comes from Socotra, and is not distinguished from it in Indian trade. Hildebrandt has ascertained that it is obtained from the stems of *Dracæna Schizantha* (Baker).

The natives remove pieces of the bark about two inches square, and the cavity in two to three weeks' time becomes filled with the resin. In Zanzibar it is used in ophthalmia, and is said to be called "Macziwa ya watu wawili," meaning the milk of two men, or "Matcho ya watu wawili," the eyes of two men.

BROMELIACEÆ.

ANANAS SATIVA, *Linn.*

Fig.—*Bot. Mag., t.* 1554; *Rheede, Hort. Mal. xi., t.* 1. Pine-apple (*Eng.*), Ananas (*Fr.*).

Hab.—America. Cultivated throughout the East. The fruit and leaves.

Vernacular.—Anannás (*Hind.*), Anánas, Anáras (*Beng.*), Annás, Aunás (*Mar.*), Anáras (*Guz.*), Anásha-pazham (*Tam.*), Aṇása-pandu (*Tel.*), Kaita-chakka, Parangi-chakka (*Mal.*), Anánasu-hannu (*Can.*).

History, Uses, &c.—The Pine-apple was unknown in India prior to the discovery of America; it was first made known to Europe by Hernandez in 1513, and was introduced into India by the Portuguese from Brazil in 1594. Its introduction is mentioned by Abu Fazl in the *Ayeen-i-akbari*, and also by the author of the *Dára Shakoh.* The vernacular names are mostly derived from the American names *Anasi* and *Nanas,* but the Malabar name Parungi-chakka signifies "European Jack fruit." Rheede states that in Malabar the leaves boiled in rice-water and mixed with *Pulvis Baleari* afford a drink which is given to dropsical patients to purge off water; the unripe fruit is given with vinegar to cause abortion and to relieve flatulent distension of the abdomen. The author of the *Makhzan-el-Adwiya* describes two kinds of pine-apple, *viz.*, the ordinary kind, and a small kind of superior sweetness and flavour called *Kaunla.* He says that the fruit is cold and moist, suitable to those of a bilious temperament, but not to the phlegmatic; to lessen its coldness it should be cut in thin slices and washed in salt and water and afterwards in pure water; it may then be sprinkled with sugar and rose-water and eaten. A little ginger is also said to render the fruit more wholesome. Pine-apple chutney, preserve, and sherbet are also mentioned, but nothing is said about the medicinal use of the leaves and unripe fruit. From the special opinions of medical officers in India recorded in the *Dict. Econ. Prod. of India* (i., 238), it appears that a belief in the abortifacient properties of the leaves and unripe fruit is common throughout India among the natives.

Chevers (*Med. Juris.*, p. 715), on the authority of Babu Kanny Lall Dey, has the following description of its use in Bengal:—"A green, unripe one, only half-grown is used. It is decorticated, and the pulpy mass of a whole one is administered to the woman with a small quantity of salt. It is efficacious only during the earlier months of pregnancy; and, after the third month, its action is very doubtful. But, if administered to suitable cases, the uterus begins to contract within twelve hours, when slight hæmorrhage occurs also. Its action then increases, and within the course of twenty-four hours the ovum is expelled. Occasionally the woman's life is jeopardized by flooding, but, as a rule, there is not much danger to be apprehended." Again, at page 718, Chevers says: "A note which I have from Babu Koylas Chunder Chatterjee renders this matter plain. He says that acid fruits are regarded as abortives. He knew a case in which a woman aborted at an advanced stage of pregnancy by eating (with that intention) about two pounds of ripe pine-apple. This fruit is rendered unwholesome by the presence of a very strong fibre which acts as a mechanical irritant on the bowels. I had under my own care an English lady who died of dysentery, after having aborted, at about the fifth month of pregnancy. The cause of her illness appeared to be the ravenous eating of raw pine-apple."

Description.—The plant is biennial, not unlike an aloe, but the leaves are much thinner, and of a hard fibrous texture, with numerous short sharp spines on the edges. The fruit is produced on a short stem which rises from the centre of the plant, and bears a scaly conical spike, surmounted by a number of small spiny leaves called the crown. This conical spike bears a number of small bluish flowers having three petals and a 3-parted calyx; after flowering, it gradually enlarges and eventually becomes a succulent fruit of a rich orange-yellow colour.

Chemical composition.—The essence of pine-apple is prepared artificially by mixing butyrate of ethyl with 8 or 10 parts of spirit of wine. Pine-apple juice contains a proteid-digesting ferment. Three fluid ounces digest 10 to 15 grains of coagulated albumen; it acts equally well in acid and alkaline solutions, and best in a neutral fluid. The juice also contains a milk-curdling ferment.

The ash has the following composition:—

Potash	49·42	per cent.
Magnesia	8·80	,,
Lime	12·15	,,
Phosphoric acid	4·08	,,
Sulphuric acid	trace.	
Silica	4·02	,,
Phosphate of iron	2·93	,,
Chloride of sodium	17·01	,,
Chloride of potassium	·88	,,

(Quoted by Kensington in *Chemical Composition of Foods, &c., &c.*)

COMMELINACEÆ.

COMMELINA BENGALENSIS, *Linn.*

Fig.—*Clarke, Comm. et Cyrt.*, 14, pl. iv.; *Wight Ic.*, *t.* 2065.

Hab.—Bengal, Peninsula, Sind, Concan. The herb.

Vernacular.—Kánchara (*Hind.*), Káchrádám, Kánchara (*Beng.*), Chura, Kanna (*Punj., Sind*), Kena (*Mar.*), Kanangkarai (*Tam.*), Venna-devi-kura, Niru-kassuvu (*Tel.*), Hittaganí (*Can.*).

History, Uses, &c.—This and several other species of Commelina are included under the Sanskrit name of Kanchata. They are small herbaceous plants which appear everywhere towards the end of the rainy season and are remarkable for their brilliant blue flowers. The stems, roots, and seeds which contain much mucilage and starch are used on account of their demulcent properties, and are eaten in times of scarcity. *C. communis* is said by Loureiro to be refrigerant and laxative, and to be useful in strangury and costiveness.

Tradescantia axillaris, *Willd., Rheede, Hort. Mal. x., t.* 13. A very similar plant, and often called by the same vernacular names, has similar properties, and its seeds have frequently proved to be a valuable resource in times of famine. Ainslie notices it under the Tamil name of Nirpulli (*Mat. Ind.*, ii., 250).

Lyon found the seeds to have the following percentage composition:—Water 10·26, fat 0·62, albuminoids 15·99, carbohydrates 54·79, cellulose 9·36, ash 8·89. The nitrogen was estimated at 11·28 grains per oz., and the nutritive carbon at 145·80 per oz. He calculates the nutritive value of the seeds as compared with the average cereal at 100·00 to be 85·76.

XYRIDEÆ.

XYRIS INDICA, *Linn.*

Fig.—*Rheede, Hort. Mal. ix., t.* 71.

Hab.—Salt marshes in Bengal, S. Concan, and Coromandel. The herb.

Vernacular.—Dádmári (*Hind.*), China-ghauza, Dábi-dúba (*Beng.*), Kochilítti-pullu (*Tam.*), Kochilachi-pulla (*Mal.*).

History, Uses, &c.—Xyris (ξυρίς) is a name given by Dioscorides (iv., 24) to a species of Iris, which has been identified with *fœtidissima*, Linn. Pliny (21, 83) speaks of the same plant as the wild Iris called by some Xyris; it appears to have been applied locally to disperse scrofulous swellings and to promote the healing of sores, and given internally as a diuretic and alterative. Linneus transferred the name to a genus of flag-like plants growing in the East and West Indies. *X. indica* does not appear to be mentioned in any of the standard native medical works, but Rheede notices its use in Malabar in the following terms:— "Foliorum succus cum aceto mixtus impetigini resistit; folia cum radice oleo incocta contra lepram sumantur; cum *mungo* (*Phaseolus Mungo,* Linn.) decocta et epota somnum consiliant." Agardh, the Swedish botanist, notices its use as a remedy for itch and leprosy. Ainslie gives the plant a place in his *Materia Indica* (ii., 125), but merely repeats what Rheede has already said. Roxburgh gives a full description of it, and remarks on the authority of the Hon'ble J. Hyde that "the natives of Bengal esteem it a plant of great value, because they think it an easy, speedy, and certain cure for the troublesome eruption called ringworms."

Description.—Root fibrous, annual; leaves radical, bifarious, straight, sword-shaped, on one edge slit into a sheath for the scape, pointed, smooth, 6—12 inches long; scape naked, round, striated, erect, length of the leaves, each supporting a round, flower-bearing head; flowers, bright yellow; bracts 1-flowered, orbicular, concave, hard, smooth; calyx 3-leaved, hid within the scale, membraneous; petals three, each supported on an unguis just long enough to raise their expanding, oval, crenate borders above the scales; filaments three; anthers twin; germ superior, 3-sided; style 3-cleft; stigma torn; capsule 3-valved, 1-celled; seeds numerous. (*Roxburgh.*)

Chemical composition.—The plant contains a red colouring matter soluble in alcohol and intensified by alkalies and having some reactions peculiar to chrysophanic acid.

PALMÆ.

COCOS NUCIFERA, *Linn.*

Fig.—*Roxb. Cor. Pl. i., t.* 73; *Rheede, Hort. Mal. i., tt.* 1 to 4. Cocoanut (*Eng.*), Cocotier (*Fr.*).

Hab.—Indian Archipelago and coasts of India. The flowers, fruit, shell, oil, juice, tomentum, root, and ash.

Vernacular.—Nárryal (*Hind., Beng.*), Náriyál (*Guz.*), Náral, Nárali mád (*Mar.*), Tenha, Tenna-maram (*Tam.*), Nári-kadam, Tenkaya-chettu (*Tel.*), Tengina-gida, Tengino-káyi (*Can.*), Tenga, Ten-maram (*Mal.*).

History, Uses, &c.—The cocoanut, formerly written coconut, derives its European names from the Portuguese *coco*, "a mask." Garcia ab Horta says: "We have given it the name of *coqus* on account of its having three holes which cause it to resemble the face of a càt or similar animal." The resemblance, however, of this nut to a head and face had not escaped the notice of the Hindus; long before the Portuguese had set foot in India, *nάral* was used as a cant term in the sense of head, pate, sconce, &c., and was sometimes used to represent the head of a dummy figure by the relatives of a deceased person whose body could not be found, and who nevertheless were desirous of rendering to it the usual funeral rites. Various superstitious uses to which the cocoanut is put in India attracted the notice of the early missionaries. Vincenzo Maria da Santa Caterina (*Viaggio alle Indie Orient.*, iii., 29) states that when an Indian falls sick, they spin a cocoanut; if it stops with its face towards the West, the sick person will die, but if it faces the East, he will recover; he also notices the offering of a cocoanut at the commencement of any building. To this we may add that on the Western Coast cocoanuts are offered to the Sea on the day of the full moon of Shravan, when the monsoon is supposed to terminate. It is related that in former days the European Governor of Bombay used to go in state and throw a golden cocoanut into the sea on this day. In Hindustan there is also a practice among the Indian Mahometans of breaking a cocoanut to ascertain whether a pregnant woman will be delivered of a male or female child; if it is empty she will be delivered of a son, if not, of a daughter: this is called "nariyal torna." Breaking a cocoanut against the wall of a person's house is in Western India an indication of enmity to the inmates of the house, and is connected with the practice of smelling the heads of children before allowing them to leave the house. The *utarna* or casting away of disease or misfortune may be performed by carrying a cocoanut to a distance from the house and breaking it.

Among the Hindus the most important function of this nut is at marriages, when it is the custom to place the *tâli* of the bride, which the parents must see and touch in token of their approbation of the marriage, in the half of a broken cocoanut. Here the *táli* and nut represent *le jeu des époux*. De Gubernatis relates that the continuance of this practice among their converts greatly exercised the patience of the Jesuit missionaries, and that the matter was finally settled in 1704 by a decree of the Cardinal de Tournon to the following effect:— "Fructus etiam vulgo dictus Coco, ex cujus fractione prosperitatis vel infortunii auspicia gentiles temere ducunt, vel omnino a Christianorum nuptiis regiciatur, vel saltem, si illum comedere velint non publice sed secreto et extra solemnitatem apariatur ab iis qui, evangelica luce edocti, ab hujusmodi auspiciorum deliramento sunt alieni." In the coast districts, cocoanuts and sugar-cakes (*náral, batása*) are lavishly distributed to the guests on important festive occasions, such as marriage, the *phool* ceremony on the event of the first menstruation and first pregnancy, and the thread ceremony; in other parts of India their place is supplied by betel-nuts. In Europe nuts appear to have been always regarded as auspicious and symbolical of fertility; the Romans scattered nuts at weddings; Virgil says, "Sparge, marite, nuces," and De Gubernatis states that this custom still exists in several parts of Southern Europe; in Piedmont there is a proverb: *Pan e nus vita da spus.*

The economic uses to which the cocoanut tree and its products are put in the East, are so numerous, and have so often been described, that we will not attempt to recapitulate them, but refer the reader to the *Dictionary of the Economic Products of India* (ii., 415). At the Colonial and Indian Exhibition, Mr. M. C. Pereira, Head Assistant to the Government Medical Storekeeper, Bombay, exhibited a collection of eighty-three articles prepared from the tree, and we are informed that he has since added considerably to his collection.

Sanskrit medical writers describe the tree under the name of Nárikela or Nárikera, and give it many synonyms, such as Tunga "lofty," Trina-rája "king of grasses," Skandha-taru "stem tree," Dur-ároha "difficult of ascent," Kúrcha-sekhara "crowned with a bunch of fruit," Dridha-phala "having hard fruit," Rasa-phala "having juicy fruit," Dridha-nira "having strong juice," &c. The tree also bears the name of Langala "membrum virile."

Dutt (*Mat. Med. of the Hindus*, p. 247) gives the following summary of the medicinal uses of the cocoa palm mentioned in Sanskrit medical works:—"The water of the unripe fruit is described as a fine-flavoured, cooling, refrigerant drink, useful in thirst, fever, and urinary disorders. The tender pulp of the fruit is said to be nourishing, cooling, and diuretic. The pulp of the ripe fruit is hard and indigestible, but is used medicinally in the preparation called *Nárikela-khanda.* The terminal bud of the tree is esteemed as a nourishing, strengthening, and agreeable vegetable. The root of the tree is used as a diuretic, and also in uterine diseases. The oil is said to promote the growth of the hair and to prevent it from turning grey, and is much used by native women; in Bengal it is scented and sold under the name of *Máthághasá.* The ashes of the leaves are used in medicine, and contain much potash. The fresh juice of the tree is considered refrigerant and diuretic; when fermented it constitutes one of the spirituous liquors described by the ancient writers. The cleared shell of the nut is burnt in the fire, and when thoroughly ignited covered up in a stone cup, the fluid thus obtained is rubefacient, and is an effectual domestic remedy for ringworm. The nárikela-khanda already mentioned is made in the following manner:—Take of the pounded pulp of cocoanut half a sér, fry it in eight tolas of clarified butter, and afterwards boil in four sérs of cocoanut water till reduced to a syrupy consistence. Now add coriander, long-pepper, bamboo manna, cumin and nigella seeds, cardamoms, cinnamon bark and leaves, cyperus root and the flowers of *Mesua ferrea,* one tola each in fine powder, and prepare a confection. The dose is two to four tolas, in dyspepsia and consumption.

The cocoa palm is supposed by some to have been the κουριόφὸρον (δένδρον) of Theophrastus (H. P. iv., 2, 7), and the

Cuci of Pliny (13,19), but their description appears to agree better with the *Hyphæne coriacea* or Doom palm of Egypt. The Arabs call the cocoanut Nárjil, and the Persians Nárgil, Bádinj, and Ránaj; their physicians describe it as hot and dry, nutritive and aphrodisiacal, beneficial to those suffering from piles; the kernel, when it has been kept for some time is considered to be anthelmintic. They remark that it is not easily digested, especially when old.

European physicians, who have practised in India, recommend the water contained in the unripe fruit as a cooling, refrigerant drink, useful in fever and urinary disorders. The milky fluid obtained by pulping the unripe kernel and expressing it has been recommended as a nutritive diet in debility and cachexia; in large doses it is aperient, and Mr. Wood has suggested its use as a substitute for castor oil. (*Pharmacopœia of India.*) The anthelmintic properties of the cocoanut noticed by Mahometan writers have been confirmed by European observers; the dose is the rasped kernel of a single nut, followed by a dose of castor oil. Cocoanut oil has been recommended as a substitute for cod liver oil, but its prolonged use is said to induce disturbance of the digestive organs and diarrhœa; this objection may be removed by using the olein separated from the solid fats, as is done by the natives in the preparation of what they call *muthel* or hand oil. To prepare this the kernel of the fresh nuts is pulped and strained and the oil separated from the milky fluid by heating it; a preparation of the same kind is now known in Europe as *coco-olein.* Cocoanut oil is not suitable as a vehicle for liniments, but the soap prepared from it, and known as *marine soap,* may be used in plaster-making and in the preparation of soap liniment; it is freely soluble in spirit. A purified cocoanut oil has of late years been introduced in Germany as a substitute for lard; it has been recommended to pharmacists as less liable to rancidity than lard. The saccharine juice obtained by cutting the spathe of the cocoa palm, when fermented and distilled, yields a clean spirit suitable for pharmaceutical purposes.

Description.—The cocoa palm, which has now been introduced into all tropical countries, grows to a height of 70 or 80 feet, and has at the apex a tuft of leaves which are twelve feet or more in length and have numerous narrow rigid leaflets. The spathe, from which toddy is obtained, when undisturbed produces numerous yellowish-white flowers succeeded by the fruit, only a small proportion of which come to maturity in about twelve months from the time of flowering. The immature fruit contains a clear sweet fluid, which gradually dries up as the nut ripens. The kernel which lines the interior of the shell, after the nuts have been kept for some time, dries up and separates from it, and is then called *khopra*; from it is obtained by hot pressure or by boiling in water the cocoanut oil of commerce, which has a mild, bland taste, a pale yellow colour, and peculiar odour. In hot climates it remains fluid, but when exposed to cold, it becomes of a butyraceous consistence and white colour. Its melting point varies between 22° and 30°C; the cold pressed oil melts at 20°C. or less; the fused, thin, transparent yellowish oil congeals between 18° and 12°C. After having been heated it remains liquid for several days. The oil is readily saponified at a low temperature, the soap being white, hard, and capable of uniting with much water.

Chemical composition.—Fresh cocoanut kernel contains water 46·64, nitrogenous substances 5·49, fat 35·93, non-nitrogenous extract 8·06, lignin 2·91, ash 0·97 per cent., and when dried yields nitrogen 1·65 and nitrogen free extract 67·33 per cent. (*König in Hammerbacher Landw. Versuchssk.* Bd. 13, s. 243.) Palm sugar examined by P. Horsin Deon (1879) yielded water 1·86, cane sugar 87·97, inverted sugar 9·65, other substances 0·50 per cent., and when dried 89·64 per cent. of cane sugar. The other organic substances consisted of 1·71 per cent. reducible sugar, 4·88 gum, and 3·06 mannite and fat. (*König, Nahrungs-mittell.*)

The milk of ripe and unripe cocoanuts has been analysed by L. L. van Slyke. The weight of milk from unripe nuts varied from 230·5 to 383·7 grams, and in a ripe nut only 109·6 grams.

The composition of the unripe milk is an average of six analyses :—

	Milk of unripe nuts.	Milk of ripe nuts.
Water at 60°	95·00	91·23
Ash	·617	1·06
Glucose.................	3·973	trace.
Cane sugar	trace.	4·42
Proteids	·133	·291
Fat	·119	·145

(*Journ. Chem. Soc.*, June, 1891.)

According to Hammerbacher, the fresh milk has the following composition :—

Water....................................	91·50	per cent.
Albuminoids	·46	„
Fat	·07	„
Nitrogen free extractive	6·78	„
Ash..	1·19	„

The milk had a sp. gr. of 1·0442. No fatty acids were present, except, perhaps, propionic.

For the composition of cocoanut *pearls*, the reader is referred to *Nature* for 1888.

Cocoanut oil has a peculiar and highly complex chemical composition. It is largely composed of the glyceride of lauric acid, $C^{12}H^{24}O^{2}$, and contains even lower homologues (*e.g.* capric, caprylic, caproic) capable of distillation in a current of open steam, and to some extent soluble in water; but the glycerides of myristic, palmitic, and stearic acids are also present in notable proportion. On the other hand, the low iodine absorption shows that comparatively little olein or its homologues can be present. (*Allen.*)

Commerce.—In 1880-81 the foreign exports of cocoanut oil amounted to 1,888,122 gallons, valued at Rs. 20,90,797, Madras alone having shipped to foreign countries 1,690,520 gallons, and sent in addition to other Indian ports, 1,493,756 gallons. In 1886-87 the exports were 1,099,864 gallons, valued at Rs. 13,24,589, and the imports 556,562 gallons, valued at Rs. 7,54,515. The bulk of the exports (*viz.*, 689,087 gallons) went to the United Kingdom. The imports were mainly from Ceylon (438,144 gallons), Bengal taking by far the largest proportion (*viz.*, 350,437 gallons). If to these facts an abstract of the coasting traffic be added, some idea of the present position of the cocoanut oil trade may be had. The imports coastwise were in 1888, 167,486 gallons, valued at Rs. 2,05,60,067 ; the exports were 1,942,829 gallons, valued at Rs. 20,74, 455. Of the imports, Bombay received 794,577, Burma 338,056, Bengal 131,463 gallons, and these quantities were almost entirely obtained from Madras. Cochin sent to Bombay 15,789 gallons, and to Madras 13,188 gallons. The other items to make up the total coastwise imports were unimportant. Local production added to these imports would constitute the supply from which the exports could be made, and in the case of Madras it is noteworthy that that Presidency imported practically no cocoanut oil, so that her exports to foreign countries and to other Indian ports were drawn exclusively from local supplies. With the exception of the small amounts obtained from Cochin, Bombay, &c., and some 6,000 gallons from Ceylon and other foreign countries, Madras imported no cocoanut oil. But she exported 1,754,701 gallons, of which 1,008,621 went to Bombay, 273,347 to Burma, 191,413 to Travancore, and 155,202 gallons to Bengal. But Bengal exported coastwise 8,648 and Bombay 3,454 gallons. The Bengal exports went to Burma, and the Bombay to Sind, Madras, Goa, Kattywar, &c. Adding the foreign exports to the coastwise exports and deducting total of the imports, we learn that Madras exported in 1888, 3,425,221 gallons—an amount which may be viewed as the surplus over local consumption. Turning to Bengal and Bombay, a very different state of affairs is found to prevail—the imports exceed the exports, in Bengal by 313,009 gallons, and in Bombay by 1,125,572 gallons. An enormous trade in cocoanut oil is done in Cochin, as will be seen from the exports for six years :—

	Europe.	India, Burma, &c.	Total Tons.
1884-85	6,613	6,066	12,679
1885-86	3,494	7,237	10,731
1886-87	4,967	5,382	10,349
1887-88	6,300	6,048	12,348
1888-89	6,193	7,775	13,968
1889-90	4,048	8,264	12,312

A very imperfect idea of the supply and demand for this oil would, however, be conveyed, were we to omit to examine the trade in dried kernel, the substance from which the oil is expressed. This is largely exported to foreign countries and sent from one province of India to another. In 1886-87 the imports were 125,222 cwts., valued at Rs. 11,76,799, and the exports 9,337 cwts., valued at Rs. 79,836. The imports come chiefly from Ceylon and the Straits Settlements, and are almost exclusively delivered in Bengal and Bombay. The exports go mainly from Madras, the greater part to Portugal, Persia, Russia, and Arabia, each receiving from 300 to 500 cwts. Of the imports by far the larger portion was received in Bombay.

Borassus flabelliformis, *Linn. Rheede, Hort. Mal. i., tt.* 9, 10, is the Palmyra palm of the English, and the Roudier a éventails of the French. In Sanskrit it is called Tála, and in the vernaculars Tál, Tád, Tár, and Panai-maram. The properties of the various parts of this noble palm are described in detail in Sanskrit medical works. The root is considered to be cooling and restorative; the saccharine juice obtained from the spathe cooling and diuretic when fresh, but intoxicating when fermented; the pulp of the ripe fruit heavy and indigestible; the gelatinous contents of the unripe seeds refreshing and cooling; the embryo of the germinating seed, and the terminal bud of the tree, are used as vegetables, and are considered to be cooling, nutritive, and diuretic; the ash of the spathe is given as a remedy for enlarged spleen.

The spirit distilled from the juice of this palm is similar to that obtained from the cocoa palm.

The fine, brown, silky substance on the young petioles of the leaves of this and other palms is used as a styptic.

B. flabelliformis yields an insoluble gum, like tragacanth, but of a darker colour.

For an account of the economic uses of this palm, the reader is referred to the *Dict. Econ. Prod. India*, i., p. 495.

Phœnix sylvestris, *Roxb., Rheede, Hort. Mal. iii., tt.* 22 to 25, Kharjura (*Sans.*), Kajúr (*Hind., Beng.*), Sendí (*Mar.*), Ishan-chedi (*Tam.*), also yields a juice, from which spirit is obtained. The fruit called *Khárik* pounded and mixed with almonds, Quince seeds, Pistachio nuts, spices and sugar forms a *Paushtik*, or restorative remedy much in vogue. A paste formed of the seeds and the root of *Achyranthes aspera* is eaten with betel leaves as a remedy for ague.

The juice of this palm is obtained by tapping the trunk.

LODOICEA SEYCHELLARUM, *Labill.*

Fig.—*Bot. Mag.*, 2734-5-6-7-8. Sea Cocoanut (*Eng.*), Coco-de-mer (*Fr.*).

Hab.—Seychelles.

Vernacular.—Darya-ka-náriyal (*Hind.*), Kadat-rengay (*Tam.*), Samudrapu-tenkaya (*Tel.*), Katal-tenna (*Mal.*), Darya-nu-náriyal (*Guz.*), Jahari-náral (*Mar.*).

History, Uses, &c.—Prior to the discovery of the Seychelles Islands in 1743, the large and peculiar-shaped nut of this palm, found floating in the Indian Ocean, was an object of curiosity which gave rise to many fabulous tales ; it was called Sea Cocoanut and Coco-de-mer by Europeans, Narjíl-bahrí by the Arabs, Narjíl-i-daryaí by the Persians, and important medicinal virtues were attributed to it. It is now no longer valued by Europeans, but is still in great repute among the Arabs and Indians as a tonic, preservative, and alexipharmic.

Rumphius gives a long account of this palm under the name of *Cocos Maldivicus*. The kernel is used in India in conjunction with *lignum colubrinum* as a tonic, and a paste made of it in conjunction with the powdered horns of the Sambhar deer and the seeds of *Strychnos Nux-vomica* is applied to enlarged glands.

Description.—Thomas Moore, in the *Treasury of Botany*, says: "This magnificent palm, which is found only in two small islands, Praslin and Curieuse, belonging to the Seychelles group, requires a great length of time to arrive at maturity. The shortest period before it puts forth its flower-buds is thirty years, and a hundred years elapse before it attains its full growth. From the age of 15 to 25 years it is in its greatest beauty, the leaves at this period being much longer than they are subsequently. The stem grows quite upright, straight as an iron pillar, and in the male trees frequently attains a hundred feet in height, the females being shorter. At the age of thirty, it first puts forth its blossoms, the males forming enormous catkins about three feet in length and [illegible] in diameter, while the females are set [illegible] strong zigzag stalk, from which hang four or five, [illegible] sometimes as many as eleven nuts, averaging about [illegible] lbs. weight each. From the time of flowering to the maturation of the fruit, a period of nearly ten years elapses, the full size, however, being attained in about four years, at which time it is soft and full of a semi-transparent jelly-like substance. The apparently peculiar formation of the root portion of this tree attracted much attention a few years since, but upon comparison with other palms it seems [illegible] to be explained as an extraordinary development of a common [illegible] system. The base of the stem is rounded and fits into a natural bowl or socket, which is pierced with hundreds of small oval holes about the size of a thimble, with hollow tubes corresponding on the outside, through which the roots [illegible] penetrate the ground on all sides, never, however, becoming attached to the bowl, their partial elasticity affording an almost imperceptible but very necessary 'play' to the parent stem when struggling against the force of violent gales. This bowl is of the same substance as the shell of the nut, only much thicker; it rots very slowly, for it has been found quite perfect and entire in every respect sixty years after the tree has been cut down." The fruits are covered externally with a thick fibrous husk, and contain usually one, but sometimes two or even three immense nuts with hard thick black shells, each being divided half-way down into two lobes. The kernel is from three-quarters to one inch thick, and very hard and white, having much the consistence of vegetable ivory: it has no odour or taste; when soaked in water it softens a little, and can be split into thin fibrous bundles.

Microscopic structure.—The kernel is composed of spindle-shaped cells having a central cavity, from which club-shaped canals extend to the cell-wall, where they are opposed to similar canals belonging to a neighbouring cell.

Commerce.—The nuts are an article of export from the Seychelles; hundreds of them may be seen at Port Victoria, Mahé, whither they are brought from the island of Praslin. Value in Bombay, Re. 1¼ per lb. for the dry kernel.

Entire nuts fetch from Re. 1 to Rs. 2 each, according to their size.

ARECA CATECHU, *Linn.*

Fig.—*Roxb. Cor. Pl. i., t.* 75; *Bentl. and. Trim., t.* 276. Areca palm (*Eng.*), Arec cultivé (*Fr.*).

Hab.—Cochin-China, Malay Peninsula and Islands. Cultivated throughout tropical India. The seed.

Vernacular.—Supári (*Hind., Beng., Guz., Mahr.*), Kamugu, Pákku (*Tam.*), Póka-vakka, Vakka (*Tel.*), Adike (*Can.*), Adaka (*Mal.*).

History, Uses, &c.—The betel-nut, in Sanskrit Guváka, Puga, and Kramuka, is a masticatory of great antiquity in the East. In the *Panchadandachattraprabandha*, Devadamani, "she who compels the gods," goes to the court of king Vīkramádītya to play with him, dressed in a sky-blue robe, having in her hand and in her mouth a betel-nut wrapped in a leaf of the *kalpa*, one of the trees of Indra's paradise, a fabulous tree, granting all desires. The betel-nut is symbolical of festivity, and is a phallic emblem. Vincenzo Maria da Santa Caterina in his Viaggio alle Indie Orientale says:—"The Hindus adorn their idols with the nuts; if a woman wears them in her hair or on her neck it is a sign that she is public." The nuts are distributed along with sugar cakes at marriages (see cocoa-nut); when wrapped in the leaves of the *Piper Betle* or *pán*, along with lime and spices, they form the *bira* or *vira*, which is so much used by the natives of all parts of India, and is commonly presented by one to another in token of civility or affection. They are also given in confirmation of a pledge, promise, or betrothal, and among the Rajpoots are sometimes exchanged as a challenge: thus the expression *bira uthâna* signifies "to take up the gauntlet," or take upon oneself any enterprise; *bira dálna*, "to propose a premium," for the performance of a task: the phrase originated in a custom that prevailed of throwing a *bira* into the midst of an assembly, in token of an invitation to undertake some difficult affair; for instance, in the first story of the "*Vetalapanchavinshati*," the king, when he sends the courtesan to seduce the penitent who was suspended from a tree nourishing himself with smoke, gives her a *bira*. *Bira dena* signifies "to dismiss" either in a courteous sense or otherwise. A *bira* is sometimes the cover of a bribe, and a *bira* of seven leaves (*sat pán ka bira*) is sent by the father of the bride to the bridegroom as a sign of betrothal. At marriages the bride or bridegroom places a *viri* or cigarette-shaped *vira* between the teeth, for the other party to partake of by biting off the projecting half; one of the tricks played on such occasions is to conceal a small piece of stick in this *viri*, so that the biting it in two is not an easy matter. The nut is also a constant offering to the gods at Hindoo temples, and on grand occasions the *bira* is covered with gold or silver leaf.

The betel-nut is mentioned in Chinese works written before the Christian era under the name of *Pin-lang*, by some supposed to be a corruption of the Malay name *Pinang;* but

Bombelon (*Pharm Journ.* [3], xvi., 838) was the first to announce that it contained a liquid volatile alkaloid, the properties and composition of which, however, he did not describe. As it seemed probable that the physiologically active constituent was to be looked for in this alkaloid, Herr Jahns was induced to investigate the subject more closely (*Berichte*, xxi., 3404). From his investigation it is clear that an alkaloid *arecoline* is the most active constituent of the nut. Its physiological action has been studied by Dr. Maumé of Göttingen (*Pharm. Zeit.*, Feb. 9, 1889, p. 97), who used for this purpose the hydrobromide and the hydrochloride, of which subcutaneous or intravenous injections were made, or sometimes the solution was applied to the conjunctiva. It was found that full-grown rabbits died within a few minutes after the subcutaneous injection of 25 to 50 milligrams, but recovered after 10 milligrams. Cats succumbed after the administration similarly of 10 to 20 milligrams, only the course of the poisoning was somewhat more prolonged. Dogs, even small animals of 5 to 6 kilograms body-weight, although strongly poisoned by the subcutaneous injection of 50 to 55 milligrams, were not always killed.

The symptoms of poisoning which were observed corresponded in many respects with those seen by Schmiedeberg in his investigation of muscarine, and further, when lethal doses were not used, they could be neutralized by means of atropine sulphate; eventually, however, they presented characteristic differences. The most dangerous action of arecoline consists in the slowing of the heart's action by small doses, or even its stoppage, just as takes place with muscarine; but the latter works in smaller doses, and it is only after somewhat larger doses of arecoline that the ventricle of the frog stops in diastole, or is so influenced that it is not emptied, and only after long intervals makes a weak undulatory muscular contraction. Subsequent injection of atropine removes this action upon the heart. Simultaneously with the heart's action the respiration is also affected. Small doses cause a considerable increase in the number of inspirations; larger doses cause a slower action with intensified expiration; and very large doses rapidly stop the breathing, especially in cats. After introvenous injection of a lethal dose the respiration usually ceases before the action of the heart.

The subcutaneous injection of 50 to 70 milligrams of arecoline salts into dogs of 4 to 5 kilograms body-weight, besides strong irritation of the heart, gives rise to tetanic cramps, which quickly give place to a partial paralysis.

As a rule, however, the animals overcome the effects of such doses, the heart resuming its action completely as the effects pass off, but it becomes again affected through vomiting and liquid evacuations in which sometimes also worms are brought away. An increased peristaltic action of the bowels is, however, provoked in rabbits, dogs, and cats by much smaller doses.

Intense poisoning of dogs, rabbits, and cats with arecoline may also be accompanied with so strong a contraction of the pupils of both eyes, that in dogs and rabbits they do not show larger than the head of a good-sized pin, whilst in cats they are reduced to a mere streak. Instillation of arecoline solution in an eye gives rise also to a strong one-sided narrowing of the pupil, but the quantity required is so large that the production of myosis in one eye may induce a flow of saliva in rabbits, and affect the heart and respiration in cats. For this reason the action of arecoline upon the human iris has not yet been tested.

It is in accord with observations made during the experiments on animals that the organism may become gradually tolerant to the poison of areca nut, as in the case of tobacco. In the opinion of Dr. Maumé, the physiological experiments indicate that the nut may prove a valuable article of the Materia Medica, since there can be no doubt that arecoline hydrobromide is capable of being utilized therapeutically on account of its effect on the peristaltic action of the bowels and also in suitable combination as a cardiac remedy. Of the other alkaloids which have been separated from areca nut, *choline* is a natural constituent of the brain-substance, and *arecaine* comes near to the trigonelline of fœnugreek. (*Pharm. Journ.*, Feb. 23, 1889.)

Description—The betel-nut has the shape of a very short, rounded cone, scarcely an inch in height; it is depressed at the centre of the base. The testa, which seems to be partially adherent to the endocarp, is obscurely defined, and inseparable from the nucleus. Its surface is marked with a network of veins, running chiefly from the hilum; these veins extend into the white albumen, giving the seed a strong resemblance to a nutmeg. The small conical embryo is situated at the base. The ripe nut is feebly astringent. Caustic lye turns the brown portion red.

Chemical composition.—The nut contains about 15 per cent. of tannin substance, and 14 per cent. of fat, colouring matter, &c. (*Pharmacographia.*) In the preparation of the bases Herr Jahns adopted two methods, which gave equally good results. According to one, the powdered seeds were exhausted three times with cold water, to which strong sulphuric acid had been added in the proportion of two grams to each kilogram of the seeds; the pressed and filtered extracts were evaporated to about the weight of the raw material used, and after cooling and again filtering precipitated with potassium-bismuth iodide and sulphuric acid. An excess of the precipitant had to be avoided, since it exercises a solvent action on the separated double salt. The red crystalline precipitate was after some days filtered out, washed and decomposed by boiling with barium carbonate and water; the alkaloids went completely into solution, whilst bismuth oxyiodide, colouring matter, &c., remained undissolved. After filtration the alkaloidal solution was evaporated to a small volume, treated with sufficient caustic baryta, and shaken repeatedly with ether, which removed a base that has been named "arecoline," on account of its oil-like character. The residual liquid, which, beside alkaloidal hydriodides, contained some barium iodide, was neutralized with sulphuric acid, and the alkaloids were set free by treatment successively with silver sulphate, caustic baryta and carbonic acid. The solution of the pure alkaloids was evaporated to dryness and the residue exhausted with cold absolute alcohol (or chloroform). "Arecaine" remained undissolved, whilst a third alkaloid, together with colouring matter, &c., went into solution, and upon evaporation of the alcohol remained as an amorphous mass.

According to the second method, the powdered areca nuts were exhausted cold with milk of lime, the filtered extracts neutralized with sulphuric acid and evaporated to a syrupy consistence. By dissolving in a little water and filtering, the gypsum and separated colouring matter were removed; the solution was then again concentrated, made alkaline, and the arecoline shaken out with ether. The other bases were then precipitated as before with potassium-bismuth iodide and sulphuric acid.

The yield of arecoline amounted to 0·07, or at most 0·1 per cent., that of arecaine to 0·1 per cent., and that of arecaidine to 0·1 per cent.

Arecoline, $C^8H^{13}NO^2$, was withdrawn from the ether solution obtained as described by shaking it with acidulated water, the neutralized liquid evaporated to a small volume, and after adding sufficient potash solution again shaken out with ether. The base left upon evaporation of this solution was neutralized with hydrobromic acid, and the dried salt perfectly purified by repeated recrystallization from absolute alcohol. From this purified compound the free base and other salts of it are prepared.

Arecoline forms a colourless oily liquid of strongly alkaline reaction, which is soluble in all proportions in water, alcohol, ether, and chloroform. It is volatile and can be distilled, the boiling point being 209°C. The salts are easily soluble, some of them deliquescent, but mostly crystallizable. It gives with potassium-bismuth iodide a pomegranate-red precipitate, consisting of microscopic crystals (a delicate reaction), and with phosphomolybdic acid a white precipitate. Potassium-mercury iodide throws down from solutions not too dilute yellow oily drops, which after several days solidify and crystallize; solution of iodine throws down brown drops, and picric acid a resinous precipitate that afterwards crystallizes in needles. Gold chloride also throws down oily drops, which, however, do not solidify. Platinic chloride, mercuric chloride, and tannic acid give no precipitates.

Arecaine ($C^7H^{11}NO^2 \cdot H^2O$), purified by repeated crystallizations from 60 per cent. alcohol, forms colourless crystals, permanent in the air, freely soluble in water and in dilute alcohol, less soluble in stronger and nearly insoluble in absolute alcohol, by which it is dehydrated. It is also insoluble in ether, chloroform, and benzol. The aqueous solution is neutral in reaction, and has a slightly perceptible weak saline taste. At 100°C. arecaine loses its water of crystallization, melts with frothing at 213°C., and carbonizes when more strongly heated. In a solution acidulated with sulphuric acid potassium-bismuth iodide produces an amorphous red precipitate that very quickly becomes crystalline. Potassium-mercury iodide is far less delicate; it does not precipitate the (neutral) solution of the free alkaloid, but if this be acidified the double salt separates in yellow needles, or at first as an oily precipitate that quickly crystallizes. Potassium iodide also fails to affect a neutral solution, but upon acid being added dark-coloured needles separate. Phosphomolybdic acid, as well as tannic acid, give a slight turbidity; picric acid gives no precipitate, and gold chloride and platinic chloride precipitate crystalline double salts from solutions that are not too dilute.

Arecaine combines with acids to form crystalline salts, having an acid reaction, freely soluble in water and less soluble in alcohol.

Arecaidine, $C^7H^{11}NO^2H^2O$, isomeric with arecaine, forms colourless, permanent, tabular crystals, and is easily soluble in water and dilute alcohol, but almost insoluble in absolute alcohol, ether, chloroform, and benzol; it loses its water of crystallization at 100°C., and melts, attended with frothing, at 222-223°C.; it forms crystallizable salts and is precipitated by platinic and auric chlorides. Arecaine and arecaidine are easily separated by treatment with methyl-alcohol and hydrochloric acid, whereby arecaidine is converted into its methyl ester, arecoline, and arecaine into the hydrochloride.

Herr Jahns (*Berichte*, xxiv., 2615) describes a fourth crystalline alkaloid in areca nuts, to which he gives the name *Guvacine*, from *guváka*, a Sanskrit name for the areca palm. Guvacine is less soluble in water or dilute alcohol than the other alkaloids, crystallizes in small shining crystals that darken at 265°C. and melt at 271-272° with decomposition. The crystals contain no water of crystallization, and upon analysis yield results corresponding to the formula $C^6H^9NO^2$. Of the salts, the hydrochloride, sulphate, nitrate, platinochloride $(C^6H^9NO^2\cdot HCl)^2\cdot PtCl^4+4H^2O$, and auro-chloride, $C^6H^9NO^2\cdot HCl\cdot AuCl^3$, have been prepared and crystallize well. It therefore appears that a series of bases occur in the areca nut, which, with the exception of choline, stand in near relation to each other—

Choline $C^5H^{13}NO^2$ Arecaine $C^7H^{11}NO^2+H^2O$
Guvacine $C^6H^9NO^2$ Arecaidine $C^7H^{1\cdot}NO^2+H^2O$
Arecoline $C^8H^{13}NO^2$

Probably other members of the series may be found by examination of a larger quantity of material. (*Pharm. Ztg.*, 1891, 516; *Pharm. Journ.*, Oct. 3, 1891.)

Toxicology.—Cases of poisoning from eating fresh betel-nuts or the poisonous nuts by mistake, not unfrequently occur, but we have not heard of any fatal termination after such accidents. The remedies used are acid pickles and copious draughts of cold water. The sufferers complain of great oppression in the chest, with a sense of faintness and suffocation, sometimes followed by vomiting. According to Maumé, arecoline separates unaltered with the secretions and excretions, from which it can be recovered. In the absence of a characteristic colour reaction, arecoline separated from urine can only be identified chemically by its behaviour with potassium-bismuth iodide, and physiologically by its action upon the heart of a curarized frog.

Commerce.—Some idea of the consumption of betel-nut in India may be formed from the fact, that in addition to her own produce India imports about 30,500,000 pounds of the nut, value about 34 lakhs of rupees, from Ceylon, the Straits Settlements, and Sumatra. The exports are under 500,000 lbs. which go to Eastern countries frequented by Indians, such as Zanzibar, Mauritius, Aden, China, &c. Bombay is the chief centre of the export trade.

The coasting trade statistics show a total of about 44,000,000 lbs., value about 55½ lakhs of rupees, passing from port to port. Bengal, Madras, and Goa are the chief producing provinces. The exports by land beyond the frontier are very trifling, about 1,000,000 lbs. going to Nepal and Bhutan.

The varieties of the nut met with in trade are numerous; they may be classed as natural and artificial: the first class includes the different varieties of ripe betel-nut produced by cultivation which have not undergone any preparation; the second class, all nuts, ripe or unripe, which have been treated by boiling or other processes before being offered for sale.

CALAMUS DRACO, *Willd.*

Fig.—*Blume in Rumphia, ii., tt.* 131-132.

Hab.—Indian Archipelago. The resin (Dragon's blood).

Vernacular.—It is known by the same names as the gum of *Dracæna Cinnabari* (p. 504).

History, Uses, &c.—The original Dragon's blood of commerce was not derived from this plant. The older writers upon Eastern commerce speak of Dragon's blood as an export to the East from Arabia and Socotra. Ibn Batuta, who visited Java and Sumatra between 1325 and 1349, makes no mention of this substance among the products of those islands. Barbosa, writing in 1514, speaks of Dragon's blood as a product of Socotra, but makes no mention of it amongst drugs found in Malacca, Java, Sumatra, or Borneo. (*Pharmacographia.*) Rumphius is the first who describes the mode of preparation followed at Palembang to procure this drug. It appears that the resin exudes in abundance from the fruit, and, being very brittle, is easily detached by shaking and friction; finally it is exposed to a heat sufficient to make it form a uniform mass. An inferior quality is said to be extracted from the crushed fruit by boiling.

This drug is not mentioned by Indian writers on Materia Medica, but it is now frequently supplied by native druggists, and their customers probably do not distinguish it from the genuine article.

Description.—Lump Dragon's blood only is imported into Bombay from the East: it occurs in large blocks of irregular form; it differs from Socotra Dragon's blood in containing remains of the fruit and numerous scales. Its fracture is somewhat porous, but in good samples the colour is nearly as brilliant as that of the drops from Socotra.

Chemical composition.—A very complete investigation of the properties of the various kinds of Dragon's blood has been made by Messrs. Dobbie and Henderson. (*Pharm. Journ.*, Nov. 10th, 1883.) They say: "Our results may be summed up as follows:—There are at least four distinct kinds of red resin presently sold as Dragon's blood, or labelled in collections under that name. One variety is brick-red in colour, melts at about 80°C., gives off red-coloured highly irritating fumes when decomposed by heat, dissolves readily with an orange-red colour in alcohol, ether, chloroform, carbon bisulphide and benzene, is insoluble or only slightly soluble in cold caustic soda, ammonia, lime water and sodium carbonate, and dissolves with difficulty when boiled in these reagents. Its alcoholic solution has an acid reaction and gives a brown-red coloured precipitate when mixed with a solution of lead acetate. Its composition may be represented by the formula $C^{18}H^{18}O^{4}$. This is undoubtedly the resin of *Calamus Draco*, some of the specimens which were examined having their origin well authenticated.

"A second variety is of a beautiful carmine-red colour, melts about 100° C., gives off non-irritating fumes when decomposed by heat, dissolves freely with a pink colour in alcohol, ether and chloroform, but is insoluble in carbon bisulphide and benzene, dissolves readily in cold caustic soda, ammonia and sodium carbonate, and much more readily than the foregoing in lime water. Its alcoholic solution has an acid reaction and gives a lilac-coloured precipitate with lead acetate. Its composition may be represented by the formula $C^{17}H^{19}O^{5}$. The source of this resin is quite uncertain. We have no means of determining whether it is identical with any hitherto described variety of red resin. The specimens examined are marked as having come from the Dutch East Indies, but beyond this we know nothing of their origin.

"A third variety is of a vermilion colour, melts about 80°C., gives off aromatic irritating fumes when decomposed by heat, dissolves with a blood-red colour in alcohol and ether, but is insoluble in chloroform, carbon bisulphide and benzene, dissolves readily in cold caustic soda, ammonia, lime water and sodium carbonate. Its alcoholic solution has an acid reaction and gives with lead acetate a mauve-coloured precipitate. Its composition may be represented by the formula $C^{18}H^{18}O^{4}$. This is the resin from a species of *Dracæna*. One of the specimens examined is from *Dracæna Cinnabari*, Socotra, and as it was gathered by Professor Balfour there can be no doubt as to its origin. Another specimen is from *Dracæna Draco*, and its origin is also well authenticated. The other specimens examined are marked some of them *Calamus*, but there can be little doubt that this is a mistake, and that all the resins having the properties just enumerated are derived from species of *Dracæna*. It seems certain then that the resin derived from *Dracæna* is totally different in property from that derived from *Calamus*.

"The fourth variety is a mixture, in varying proportions, of a reddish-brown coloured resin, freely soluble in carbon bisulphide, and a light brick-red coloured resin, nearly insoluble in carbon bisulphide. The two portions also differ considerably as regards their solubility in ether, benzene, and other reagents, the dark portion being in all cases the less soluble of the two. Since, however, it dissolves to a slight extent in all reagents, we found it impossible to effect a complete separation of the two portions. The portion freely soluble in carbon bisulphide is probably identical with the resins of our first class, while the other portion seems to be a distinct resin.

"Much discussion has taken place with regard to the presence of a volatile acid in Dragon's blood. It seems certain that none of the varieties of this resin contain benzoic acid; at all events we failed to obtain an extract from any of them with petroleum ether, in which benzoic acid is freely soluble. We tested for cinnamic acid by sublimation, and found it present in the resins of the first and third classes, but not in those of the second and fourth classes. To ascertain the delicacy of this method we made a preliminary experiment with artificial mixtures containing 1 per cent. of cinnamic acid, and found that the acid could be separated out by sublimation from very small quantities of such a mixture. Probably the error as to the presence of benzoic acid arose through confounding it with cinnamic acid, or possibly from working with a resin in which benzoic acid had been formed by partial oxidation."

PANDANACEÆ.

PANDANUS ODORATISSIMUS, *Linn. f.*

Fig.—*Roxb. Cor. Pl. i., tt.* 94—96. Screw Pine, Kaldera bush (*Eng.*), Pandan odoriferante (*Fr.*).

Hab.—India, Persia, Arabia. The stems, male inflorescence and seeds.

Vernacular.—Keora (*Hind.*), Keya (*Beng.*), Kevada (*Mar.*), Kevado (*Guz.*), Tázhan-chedi (*Tam.*), Mogali-chettu, Gájangi (*Tel.*), Tázha, Kaita (*Mal.*), Tále-mara, Kyádage-gida (*Can.*).

History, Uses, &c.—The Ketaka or Dhúli-pushpika "dust flower," whose golden spikes of flowers are said to atone for all its defects, is a great favourite with Vishnu and Krishna, and its flower-leaves are much worn by women in their hair. The poets also celebrate its perfume. In the play of Malati and Madhava, the latter says:—

> The slowly rising breezes spread around
> The grateful fragrance of the Ketaka.

A strophe quoted by Böhtlingk (*Indische Sprüche*, i., 2083) says:—The drunken bee mistakes the golden flowers of the Ketaka for a lotus, and blinded by desire rushes into the flower and leaves his wings behind him. In the Gita Govinda, the bracts are likened to a lance fit to pierce the hearts of lovers, and the opening buds of the Jasmine are supposed to be impregnated by its pollen.

The defects of this plant are described as its crookedness, abundance of thorns (suchi-pushpa), and the desert places which it selects for a habitation. The Ketaka is obnoxious to Siva, and the following story is told to account for his hatred of the tree: Gambling with Parvati he is said to have lost everything he possessed, even to down the clothes upon his back. In a fit of repentance he wandered away and was lost to his friends, who afterwards discovered that he had retired into a forest of Ketaka trees and had become an ascetic. Parvati, having assumed the form of a Bhil damsel with Ketaka in her hair, followed him into the forest, and having succeeded in making him break his vow afterwards upbraided him for inconstancy; whereupon he cursed the Ketaka and any one who should offer its flowers at his shrine. This episode is the subject of a well-known Marathi *luoni*:—

> Siva sáthi jhali bhilina
> Jaga mohini Girja jhali udása.
>
> Unhappy Girje, erst the world's ador'd
> A gipsy maid now, seeks for Shiv her lord.

According to the Nighantás, the plant has bitter, sweet, light, and pungent properties, and removes phlegmatic humors.

In Persia it is called Kádi, Gulkiri, and Gul-i-kabadi; the Arabs call it Kádi and Kadar. Rázi recommends it in leprosy and small-pox; it is considered by Mahometan physicians to be cardiacal, cephalic, and aphrodisiacal. They prepare a *sharab* by boiling the pounded stems in water, also a distilled water from the flowering tops and a perfumed oil. Mir Muhammad Husain states that the Hindus believe that if these preparations are used when small-pox is prevalent, the disease will be averted, or be of so mild a form as to be free from danger. The ashes of the wood are said to promote the healing of wounds, and the seeds to strengthen the heart and liver.

In India the perfumed oil is prepared by placing the floral bracts in sesamum oil and exposing it to the sun for forty days; fresh bracts are supplied and the old ones removed several times during this period. This oil is much valued as a perfume, and is used as a remedy for earache and suppuration of the meatus. The distilled water may be simple or compound; in the latter case the bracts are distilled with rose-water or sandalwood chips; it is used as a perfume and to flavour sherbets.

The leaves of several species of Pandanus are used for making mats and to polish lacquer-ware, and the fruit has been eaten in famine times. The edible species (*P. edulis, Thonars*), common in Madagascar and the islands of the South Pacific, does not occur in India. The aerial roots of the different species are much used to make coarse brushes in the East, a portion of the desired length being cut and the end beaten until the fibres separate.

Description.—The male inflorescence is a large, terminal, pendulous, compound, leafy panicle, the leaves of which are yellowish-white, linear-oblong, pointed and concave, the margins being armed with very fine sharp spines; in the axil of each there is a single thyrse, composed of simple, small racemes of long, pointed, depending anthers, which are not sessile, but raised from the rachis of these partial racemes by tapering filaments. The fruit is compound, oval, from six to eight inches in diamater, and from six to ten long, weighing from four to eight pounds, rough, of a rich orange colour, composed of numerous, wedge-shaped, angular drupes; when ripe their large or exterior ends are detached from one another, and covered with a firm, orange-coloured skin; apices flat, consisting of as many angular, somewhat convex tubercles as there are cells in the drupe, each crowned with the withered stigma, internally the exterior half of these drupes next the apex consists of dry spongy cavities, their lower part, next the core or common receptacle, is yellow, consisting of a rich-looking, yellow pulp, intermixed with strong fibres; here the nut is lodged. Nut of each drupe compound, turbinate, exceedingly hard, angular, containing as many cells as there are divisions in the apex of the drupe; each cell is perforated above and below. Seeds single, oblong, smooth, adhering lengthwise to a small fasicle of strong white fibres, which pass through the perforations of the cell. (*Roxburgh.*)

TYPHACEÆ.

Typha angustifolia, *Linn.*, *Eng. Bot.* 1456. *Vern.*—Rámabána. The soft woolly inflorescence of the male spadix is applied like cotton to wounds and ulcers. The plant is abundant on the banks of the Indus, where it is called "Pun." From the pollen is made the Búr or Búratú, much eaten by the natives of Sind. The Sanskrit name is Eraka.

Description.—Perennial, culms straight, 6 to 10 feet high, round, smooth, jointed at the insertion of the leaves; leaves long, ensiform, obtuse, flat on the inside, as long or nearly as long as the stem, about 3 to 4 inches broad; sheath smooth, embracing the culms; male catkin 2 to 3 inches above the female, cylindric, 8 to 10 inches long, densely covered with stamens, and numerous 3 to 4 cleft fine filaments, each with 2 to 3 anthers; anthers linear; female catkin 8 to 10 inches long; glume with fine filaments.

AROIDEÆ.

ACORUS CALAMUS, *Linn.*

Fig.—*Bentl. and Trim., t.* 279; *Rheede, Hort. Mal. xi., t.* 48. Sweet-Flag (*Eng.*), Acore vrai (*Fr.*).

Hab.—Central Asia. Cultivated throughout India. The rhizome.

Vernacular.—Bach, Gorá-bach (*Hind., Beng.*), Vekhand, Gora-bach (*Guz.*), Vekhand, Bál-vekhand (*Mar.*), Vashambu (*Tam.*), Vasa (*Tel.*), Vashanpa (*Mal.*), Vajé (*Can.*).

History, Uses, &c.—This plant bears the Sanskrit names of Vachá "talking," Shadgrantha "six-knotted," Ugragandha "strong smelling," Jatilá "having entangled hair," &c., and is described in the Nighantás as hot, pungent, bitter, stomachic and emetic; useful for clearing the voice by removing phlegm, and in colic. As an emetic it is administered in doses of about 80 grains with half a *sér* of tepid salt water; in dyspepsia it is given in combination with asafœtida, long pepper, black pepper, ginger, chebulic myrobalans, *sonchal* salt, and the tubers of *Aconitum heterophyllum*, of all equal parts, in doses of half a drachm. As a stimulant or nervine it is used in combination with other remedies in low fevers, epilepsy, and insanity. The authors of the *Pharmacographia* remark—"The descriptions of *Acoron*, a plant of Colchis, Galatia, Pontus, and Crete, given by Dioscorides and Pliny, certainly refer to this drug." The Arabian physicians also agree in identifying it with the *Acoron* of the Greeks, a name probably derived from the Persian *Agar*. Ibu Sina describes the drug under the name of Waj, and quotes Galen with regard to its properties, and all the Arabian and Persian physicians reproduce what Dioscorides has written concerning ακόρον. That this plant is not the *Calamus aromaticus* of the ancients appears to be evident, as Pliny describes both *Acoron* and *Calamus aromaticus*. The Arabians also do not identify the plant with *Calamus aromaticus*, but describe the latter under the name of Kasab-ed-darira and identify it with *Swertia Chirata.* Hájá Zein states that in his time (1368) Kasab-ed-darira came from Calicut, where it was called by the natives *Báringa;* if this statement is correct, the drug used by him must have been either *Premna herbacea* or *Clerodendron serratum,* the Bháringa of the Hindus. Royle supposes *Calamus aromaticus* to have been an Andropogon. Mahometan writers describe it as deobstruent and depurative, useful for the expulsion of the phlegmatic humours, which they suppose to be the cause of paralysis, dropsy, and many other diseases; they recommend it to be given to children to bite when teething, and prescribe it internally in calculous affections. It has also a reputation as a diuretic, emmenagogue, and aphrodisiac, and is applied in the form of poultice to paralysed limbs and rheumatic swellings. A pessary composed of Acorus, saffron, and mare's milk is used to promote delivery; a hip bath of the decoction is also said to be efficient for this purpose. Dr. Ondaatji, Colonial Surgeon of Ceylon, has brought to notice the use of sweet-flag as an anthelmintic in that island. He says: "An infusion of the rhizome given to young children acts effectually, as I have seen many such cases treated among the natives." Dr. Evers at the Seoni Main Dispensary has found the drug very effectual in dysentery. He uses the following decoction:—Bruised rhizome 2 ozs., Coriander 1 dr., Black pepper ½ dr., Water one pint. Boil down to 12 ounces, and let cool. Dose for an adult 1 ounce three times a day; for a child 1 to 3 drachms, sweetened with sugar, two or three times a day. He also remarks:—"The decoction is not only useful in dysentery and diarrhœa, but also in the bronchitic affections of children." I have often taken it myself when suffering from a bad cold in the chest. (*Ind. Med. Gazette,* Feb. 1875.)

The evidence collected by Dr. Watt for *Dict. Econ. Prod. of India* testifies to the value of Acorus as an aromatic bitter and stimulant, especially useful in allaying distressing cough.

Description.—The root-stock occurs in somewhat tortuous, sub-cylindrical or flattened pieces, of variable length; to the upper surface of these is attached the lower portion of the leaves which have been cut off; on the under surface may be seen a zigzag line of little elevated dot-like rings, the scars of roots. The root-stock is usually rough and shrunken, varying in colour from dark-brown to orange-brown, breaking easily with a short corky fracture, and exhibiting a whitish spongy interior. The odour is aromatic and agreeable; the taste bitterish and pungent. The Persian variety of Acorus is darker in colour when fractured and has a more powerful odour, the leaves have been entirely removed, instead of being cut off short.

Microscopic structure.—A section of the rhizome is like an open network composed of rows of nearly round cells and open spaces (water passages); most of the cells contain small starch granules, but some of them essential oil; at the junction of the cortical and central portions of the rhizome is a very distinct row of small empty cells. The vascular bundles are numerous, especially just within the line of small cells just noticed; each bundle consists of a ring of spiral vessels surrounding a number of jointed tubes.

Chemical composition.—The authors of *Pharmacographia* say:—“ The dried rhizome yielded us 1·3 per cent. of a yellowish neutral essential oil of agreeable odour, which in a column of 50 mm. long deviates the ray of polarized light 13·8° to the right. By working on a large scale, Messrs. Schimmel & Co., of Leipzig, obtained 2·4 to 2·6 per cent. According to Kurbatow (1873), this oil contains a hydrocarbon, $C^{10}H^{16}$, boiling at 159° C., and forming a crystalline compound with HCl, and another hydrocarbon boiling at 255—258° C., affording no crystallizable hydrochloric compound. By submitting the oil to fractional distillation, we noticed, above 250°, a blue portion, which may be decolourized by sodium. The crude oil acquires a dark-brownish colour on addition of perchloride of iron, but is not at all soluble in concentrated potash solution.

The bitter principle, *Acorin*, was isolated by Faust in 1867, as a semi-fluid, brownish glucoside, containing nitrogen, soluble both in ether and in alcohol, but neither in benzol nor in water. In order to obtain this substance, we precipitated the decoction of 10 lbs. of the drug by means of tannic acid, and followed the method commonly practised in the preparation of bitter principles. By finally exhausting the residue with chloroform, we succeeded in obtaining a very bitter, perfectly crystalline body, but in so minute a quantity that we were unable to investigate its nature." (*Op. cit.*, 2nd Ed., p. 678.)

Herr Thoms (*Archiv. der Pharm.* [3] xxiv., p. 465) announced the absence of nitrogen in acorin, which is contrary to the results obtained by Faust; at the same time this author states that under the influence of acids and alkalies, or of emulsin, acorin splits up into sugar and carburet of hydrogen, and that it readily oxidizes and is converted into a resinous substance *acoretin*, which, when reduced from alkaline solution by nascent hydrogen, gives an essential oil and sugar as final products.

The fact of a glucoside behaving in this way being inadmissible has led M. Geuther to make a fresh examination of acorin, which he obtained by exhausting the root with cold water and separating the acorin by means of animal charcoal; the impure acorin was then removed from the charcoal by means of alcohol, and, after purification, was found to contain 3·2 p. c. of nitrogen, 70·0 of carbon, and 9·1 of hydrogen. Treated with a boiling dilute solution of soda it yielded no sugar, but was converted into an acid substance which strongly reddened litmus; treatment with dilute acids also yielded no sugar. Exhausted by soda, the bitter matter has the formula $C^{80}H^{67}NO^{14}$, and the acid which has been yielded to the alkali has the formula $C^{22}H^{18}O^{6}$; treated with hydrochloric acid it sets free an acid of the formula $C^{22}H^{16}O^{3}$ or $C^{22}H^{18}O^{8}$, which appears to be a product of the oxidation of the free acid already noticed. M. Geuther considers that the acoretin of Herr Thoms is nothing but impure acorin. (*Annalen der Chem.*, ccxl., p. 92.)

SCINDAPSUS OFFICINALIS, *Schott.*

Fig.—*Wight, Icon., t.* 781.

Hab.—Bengal. The fruit.

Vernacular.—Gaj-pipli, Bari-pipli (*Hind.*), Gaja-pipal (*Beng.*), Atti-tippili (*Tam., Mal.*), Enuga-pippallu (*Tel.*), Dodda-hipalli (*Can.*), Thora-pimpali (*Mar.*), Motho-pimpali (*Guz.*).

History, Uses, &c.—The ripe fruit of this plant is the true Gaja-pippali of the Nighantás; it also bears the Sanskrit names of Kari-pippali, Kapi-valli, Kota-valli, Shreyasi, and Vashira. It is described as aromatic, carminative, stimulant, and useful in diarrhœa, asthma, and other affections supposed to be caused by deranged phlegm. In practice it is generally used as an adjunct to other medicines. *S. officinalis* is cultivated in Bengal, chiefly in the Midnapore district, and the fruits, cut into transverse pieces and dried, form the Gaja-pipal of the druggists of Eastern and Southern India.

In Northern and Western India an entirely different drug is sold under the same name; it consists of the entire plant of a Balanophora often remaining attached to a small piece of the dead stick upon which it grew. The largest of these plants are about five inches in length, and consist of a kind of cellular cup, from which springs a scaly spadix surmounted by a glandular-shaped club of imperfect flowers, beneath which the stem is marked by little pits showing the places where the female flowers were attached. This drug is mucilaginous and astringent, and is no doubt improperly substituted for the genuine article.

Description.—The fruit of *S. officinalis* occurs in slices an inch or less in diameter and about ¼ inch in thickness, of a greyish colour and almost inodorous. The slices consist of a central core surrounded by the seeds partly enclosed in the dried pulp of the arils; when soaked in water they swell up and soften, and the core may be seen to contain numerous large liber cells very sharply pointed at both ends which act like stinging hairs. The pulp surrounding the seeds is full of needle-like crystals of oxalate of lime, similar to those found in the acrid corms of other aroids. The seeds are rather larger than hemp seeds, kidney-shaped, grey and polished; they contain a white oily kernel.

Chemical composition.—With the exception of a minute trace of an alkaloid, nothing of special interest was detected. The mucilage afforded jelly-like precipitates with plumbic acetate and ferric chloride. No tannin was present. Ash, 14·6 per cent.

Scindapsus pertusus, *Schott., Rheede, Hort. Mal. xii., tt.* 20, 21, is a large perennial plant, running over trees and rooting on them like Ivy; leaves alternate, resembling those of the Pipal (*Ficus religiosa*) but larger, often perforated and cut in the margins; spadices shortly-peduncled; spathe gibbous, acute, a little longer than the spadix; spadix cylindric-obtuse. The juice of the plant with black pepper is given to people who have been bitten by the *Kusriya Ghanas,** a snake so called because the part bitten by it mortifies. The juice, with that of the roots of *Croton oblongifolium* and of the fruit of *Momordica Charantia,* is also applied to the bitten part.

ALOCASIA INDICA, *Schott.*

Fig.—*Wight Ic., t.* 794.

Hab.—India, cultivated in Bengal and elsewhere. The root-stock.

Vernacular.—Mánkand, Kachu (*Hind.*), Mán-kachu (*Beng.*), Kás-alu (*Mar.*).

History, Uses, &c.—This large Arum is the Mánaka of Sanskrit writers; its root-stock is a valuable and important article of diet in Bengal, and often grows to an immense size, being from six to eight feet in length, and as thick as a man's leg. When dried it can be kept for a considerable time and affords a large supply of starchy food. In Western India it is much cultivated as an ornamental plant in gardens, but is little known as an article of diet; the acrid juice of the petioles is, however, much used as a common domestic remedy on account of its styptic and astringent properties. The petiole is slightly roasted and the juice expressed. We have seen purulent discharge from the ears in children stopped by a single application. The tubers chopped fine, tied in a cloth and heated, are used as a fomentation in rheumatism.

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* Daboia Russellii, a viper.

Medicinally *mánaka* is said to be useful in anasarca, in which disease it is used in the following manner. Take of the meal of the root-stock eight tolás, rice-meal sixteen tolás, water and milk forty-eight tolás each; boil them together till the water has evaporated. This preparation is called *Mánamanda*, and is given as an article of diet to the patient, nothing else being allowed during its administration except milk. (*Chakradatta.*)

As a vegetable, the root-stock is peeled, cut in small pieces and well boiled to remove its acridity; it is then mixed with other vegetables and cooked with the usual condiments. Dr. D. Basu (*Dict. Econ. Prod. Ind.*, i., 178) remarks—"I have never used it solely as a medicine; but as food taken frequently, it seems to act as a mild laxative and diuretic. In piles and habitual constipation it is useful." Surgeon-Major R. S. Dutt (*idem*) states that it is a very agreeable vegetable during convalescence of natives from bowel complaints; it is light and nutritious and somewhat mucilaginous. The ash of the root-stocks mixed with honey is a popular remedy for aphthæ.

Description.—The root-stock occurs in large round pieces, a foot or more in length, and covered externally by the brown dried remains of the leaf petioles and their sheaths. Internally it is white, opaque, and starchy, and when fresh has an acrid odour which is lost on drying. Pulped and washed it yields a large quantity of pure white starch.

Chemical composition.—The acridity of this plant has been shown by Pedler and Warden (*Jr., Asiatic Soc., Bengal*, Vol. LVII., Part II.) to be due to the large number of acicular crystals of oxalate of lime contained in its tissues.

AMORPHOPHALLUS CAMPANULATUS,

Blume.

Fig.—*Roxb. Cor. Pl. iii., t.* 272; *Bot. Mag., t.* 2812; *Wight Ic.*, 785.

Hab.—India. Much cultivated. The tubers.

Vernacular.— Jimi-kand (*Hind.*), Ol (*Beng.*), Surana (*Mar., Guz.*), Suranu (*Can.*), Karunai-kizhangu (*Tam.*), Kanda-godda (*Tel.*), Karuna-kizhanna (*Mal.*).

History, Uses, &c.—This arum occurs as a wild plant on the banks of streams and also in several cultivated forms. It is the Surana and Olla of Sanskrit writers, and among other synonyms bears that of Arsoghna or "destroyer of piles." For medicinal use, Sarangadhara directs the tuber to be covered with a layer of earth, roasted in hot ashes, and administered with the addition of oil and salt. Several confections are also used, such as the *Laghuourana modaka, Vrihat surana modaka, &c.*; these are made of the tubers of the plant with the addition of treacle, aromatics (ginger and pepper) and Plumbago root, and are given in doses of about 200 grains once a day in piles and dyspepsia. The dried tubers of the wild plant, peeled and cut into segments, are sold in the shops under the name of *Madan-mast.* The segments are usually threaded upon a string, and are about as large as those of an orange, of a reddish-brown colour, shrunken and wrinkled, brittle and hard in dry weather; the surface is mammillated. When soaked in water they swell up and become very soft and friable, developing a sickly smell. A microscopic examination shows that the root is almost entirely composed of starch. Madan-mast has a mucilaginous taste, and is faintly bitter and acrid; it is supposed to have restorative powers, and is in much request; it is fried in ghí with spices and sugar. It is interesting to note that the tubers of the greater Dracontia (*Diosc.*, ii., 155) were preserved by the Greeks in the same manner for medicinal use. The cultivated plant is largely used as a vegetable; under cultivation it loses much of its acridity and grows to an enormous size.

Synantherias sylvatica, Schott., is regarded by the Hindus as a kind of wild *Surana*, and, with the wild form of *Amorphophallus campanulatus*, bears the Sanskrit name of Vajra-kanda "thunder-bolt." The country-people use the crushed seed to cure toothache; a small quantity is placed in the hollow tooth and covered with cotton; it rapidly benumbs the nerve; they also use it as an external application to bruises on account of its benumbing effect. In the Concan the seeds rubbed into a paste with water are applied repeatedly to remove glandular enlargements. The fruit is yellow, about the shape and size of a grain of maize, closely set round the upper part of the spike, which is several feet in height, and as large as that of the plantain. The skin of the fruit is tough, the pulp scanty and yellow; it encloses two seeds having the shape of a coffee bean, and placed with their flat surfaces in apposition. The testa of the seed is soft, greenish-brown externally, green internally; the kernel is white, adhering closely to the testa, soft and juicy when fresh, but rapidly becoming hard and dry when cut. The taste is intensely acrid, after a few seconds it causes a most painful burning of the tongue and lips, which lasts for a long time, causing much salivation and subsequent numbness. A section of the fruit and seed show the following structure from without inwards :—1*st*, several rows of thick-walled cells, having yellowish-brown granular contents (skin); 2*nd*, a parenchyma composed of thin-walled cells, having no solid contents except needle-shaped crystals (pulp); 3*rd*, several rows of small cells containing chlorophyll (testa of seed); 4*th*, a delicate parenchyma, the cells of which are loaded with very small starch granules, mostly round, some truncated.

The tubers of *Sanromatum pedatum*, Schott., are very acrid, and are used externally under the names of Bhasamkand and Lót as a stimulating poultice. The plant is extremely common, and its pedate leaves appear with the first rain in June. The flower, which is produced just before the rains, seldom attracts notice, being more or less buried in the soil. The tubers are about as large as small potatoes, and of the same shape as those of the Surana.

CRYPTOCORYNE SPIRALIS, *Fisch.*

Fig.—*Wight Icon.*, *t.* 773.

Hab.—Marshy banks and standing water. Southern India. The rhizome.

Vernacular.—Nattu-ati-vadayam (*Tam.*), Nátti-ati-vasa (*Tel.*).

History, Uses, &c.—The Ati-vadayam of the Tamils is the Atís of Northern India, and is the tuber of *Aconitum heterophyllum*. The country Atís of the Madras Presidency has for a long time been undetermined, until in 1888 Mr. M. A. Lawson was able to refer it to *Cryptocoryne spiralis* and a species of Lagenandra. Moodeen Sheriff says the root bears a strong resemblance externally to Ipecacuanha, and he has used it as a tonic and anti-periodic with children. It attracted attention a few years ago through several packages of it appearing in the London market as "False Ipecacuanha." It is a well-known drug in Ceylon, where it is employed by the native doctors in decoctions in combination with other drugs as a remedy for infantile vomiting and cough, and in the case of adults for abdominal complaints and fever. The Singhalese obtain the drug from India and value it at 4 annas per pound retail.

Description.—Leaves petioled, linear-lanceolate; spathe sessile, much shorter than leaves, twisted; ovary 5-celled. The rhizome is about the thickness of a small quill. The drug appears in broken pieces from ½ to 1½ inch long, annulated, of grey or dark-grey colour externally and white internally, inodorous and acrid in taste.

In the Cryptocoryne the annulations are not so frequent, and the drug is more slender than in the Lagenandra.

Chemical composition.—The drug contains starch and numerous bundles of raphides, but no alkaloidal active principle has been separated.

Lagenandra toxicaria, *Dalz.*, *Rheede, Hort. Mal. xi.*, *t.* 23, is a marsh plant, three feet high, with a thick, creeping, fleshy rhizome, juicy and white, sending off numerous thick fleshy roots of a white colour. The leaves are on long petioles, oblong, obtuse, entire coriaceous, large; sheaths stipulary, opposite the leaf; scapes axillary, solitary, compressed; spathe longer than the scape, tubular at the base, attenuated into a long, slender apex; fruit compound, about 1 inch in diameter; seeds cylindric-oblong, minute, several in each cell, erect from the base. The plant is a native of Southern India, and is considered to be very poisonous. Rheede says of it:—"Balneum ex hac planta præparatum omnem corporis æstum reficit."

Rheede (xii., 9) states that the root of *Remusatia vivipara*, Máravara Tsjembu (*Mal.*), Rukh-alu (*Mar.*), is made into an ointment with turmeric and used as a remedy for itch, and that the juice with cow's urine is considered to be alexipharmic.

TACCA ASPERA, *Roxb.*

Hab.—Tropical India. The tubers.

Vernacular.—Váráhi-kand (*Hind.*, *Beng.*), Dukar-kand (*Mar.*, *Guz.*), Handi-gadde (*Can.*).

History, Uses, &c.—This plant is the Váráhi-kanda or Súkara-kanda of the Nighantás, so called from its being a favourite food of the wild boar. It is described as sweet, digestive, nourishing and tonic; useful in cachectic affections, such as leprosy, &c. *T. aspera*, *T. lævis*, and *T. pinnatifida* all have tuberous roots, from which a starch resembling arrowroot may be obtained, and all three plants are probably utilized by the herbalists, who usually supply the coarsely prepared starch to their customers.

Description.—The root is an oblong curved tuber, of a middling size, with wiry fibres from its sides; externally of a dark-brown or blackish colour, and internally of a pale yellowish white. It has a bitter, nauseous taste. A full description of the plant, as well as of the two other species mentioned, will be be found in Roxburgh's *Flora Indica.*

PISTIA STRATIOTES, *Linn.*

Fig.—*Roxb. Cor. Pl. iii., t.* 268; *Rheede, Hort. Mal. xi., t.* 32. Water soldier (*Eng.*).

Hab.—Tanks and ponds of India. The whole plant.

Vernacular.—Jal-Kunbhi (*Hind.*), Gondála, Shérval (*Mar.*), Agasatamaray (*Tam.*).

History, Uses, &c.—Amongst the Sanskrit names of this plant we may notice Jalodbhuta, Jalàsaya, Guccha-bodhra, and Paniya-prishthaja "born on the surface of water." This aquatic plant is a native of Asia, America, and Africa; it is considered by the Hindus to be cooling and demulcent, and is prescribed in cases of dysuria in the quantity of about ten pagodas' weight twice daily; the leaves are made into a poultice for the piles. (*Ainslie.*) The ashes are applied to ringworm of the scalp, and in some parts of India are known as 'Páná salt.'

A notice of the plant will be found in Arabic and Persian medical works under its Greek name στρατιώτης.

Description.—Often found floating on stagnant pools, leaves sub-rotund, obcordate, rosulate, waved on the margins, the nerves spreading like a fan, uniting into a truncate arc at the base; spadices axillary, solitary, seated on a short scape.

Chemical composition.—The plant and salt have been examined by Warden of Calcutta, who reports that the weed dried at 130°C. and carbonized yielded 31 per cent. of total ash, of which 6 per cent. was soluble. The sample of "salt" was slightly deliquescent, alkaline in reaction, and had the appearance of dirty common salt. Dried at 130° it yielded 73 per cent. of potassic chloride, 22·6 per cent. of potassic sulphate, and minute quantities of potassic carbonate, sodic chloride, calcic sulphate, magnesic sulphate, and ferric, aluminic and silicic oxides. (*Chem. News*, March 23, 1883, p. 133.)

DIOSCORINEÆ.

This genus is of much importance as a source of food in India, and some of the species are used medicinally on account of their acrid or bitter properties. In Sanskrit they bear the general name of *alu*, and the different species are distinguished by prefixes, *e.g.*, Madhválu "sweet yam" (*Dioscorea aculeata*), Pindálu "globose yam" (*D. globosa*), Raktálu "red yam" (*D. purpurea*), &c. But the Sanskrit name *alu* is also applied to other plants having tuberous roots, and it is therefore difficult to say what the original meaning of the word may have been. *Dioscorea bulbifera* in its wild state is extremely bitter; the small potato-like tubers on the vine dried and powdered are used as a medicinal application to sores, and are given internally in 4 massa doses with a little cumin and sugar in milk as a remedy for syphilis and for dysentery; the powder made into a bolus with butter is given to check diarrhœa; the roasted tubers of the cultivated variety made into balls with ghí and sugar-candy have a reputation as a remedy for piles: under cultivation the plant loses its bitterness, and is much grown for the tubers which are roasted and eaten.

D. triphylla is very acrid, and its tubers are sometimes used as a plaster to disperse swellings. We have received the tuber of this yam from Burma, where it is used as a poison; when taken internally it causes great irritation in the mouth and throat, vomiting of blood, a sense of suffocation, drowsiness, and exhaustion: and it is said that a piece of the tuber, the size of an apple, is sufficient to cause death in six hours. Nevertheless the Burmese use it as an article of food after it has been cut in thin slices, repeatedly washed, and steamed in an earthen pot. The Burmese name is Choo-ay-oo. In Sanskrit the tuber bears the name of Pàshpoli "strangle cake." For an account of the economic uses of the different species of Dioscorea cultivated in India, we must refer the reader to the *Dict. Econ. Prod. of India*, iii., p. 115.

The tubers yield a milky juice containing a small quantity of fat, a resin, and caoutchouc. Analysis of tubers—Water 60·722, Ash free from C,CO,^{2} and Si O^2 0·895, Protein compounds 4·485.

The following analyses of *D. alata* and *edulis* are by Payen (*Compt. rendus*, xxv., 1847, and Moser, *Landw. Versuchsst. Bd.*, 20, 1877).

	Dioscorea alata.	D. edulis.
Water	79·64	60·72
Nitrogenous matter	1·93	4·48
Fat	...	0·35
Nitrogen free extractive ...	17·33	32·47
Cellulose	...	1·09
Ash	1·10	0·89
In dry substances.		
Nitrogen	1·52	1·82
Carbohydrates	...	82·66

The nitrogen-free extractive of *D. alata* contained 4·79 per cent. cane-sugar, ·18 per cent. cellulose, and 25·19 per cent. starch.

CYPERACEÆ.

CYPERUS ROTUNDUS, *Linn.*

Fig.—*Rottl.* 28, *t.* 14, *f.* 2.

Hab.—Throughout India. The tubers.

Vernacular.—Motha (*Hind., Guz.*), Korai (*Tam.*), Bhadramuste, Tunga-muste (*Tel.*), Bimbal, Bárik-motha (*Mar.*), Mutha (*Beng.*).

History, Uses, &c.—This is the Mustaka of Sanskrit writers; it is considered to be diuretic, diaphoretic, astringent, and stomachic, and is prescribed in febrile affections and derangements of the bowels. In Indian domestic medicine the fresh tubers are applied to the breast in the form of a paste as a galactagogue.

C. rotundus is doubtless the سعد (Suad) of Abu Hanifeh, who describes it as a certain kind of sweet-smelling root or rhizome (ارومة), round, black, hard like a knot, which is an ingredient in perfumes and medicines. In the *Kámús* it is said to possess a wonderful efficacy for healing ulcers and sores. Ibn Sina says that the best kind of Suad is that which comes from Kufa in Chaldea, and that the Indian drug (*C. scariosus*) is said to make the hair grow thin. He, along with other Arabian and Persian writers, describes the drug as attenuant, diuretic, emmenagogue, lithontriptic, and diaphoretic; they prescribe it in febrile and dyspeptic affections, and in one ounce doses as an anthelmintic; externally it is applied to ulcers, and used as an ingredient in warm plasters.

Dioscorides calls it *κύπερος* and notices its use as a diuretic and emmenagogue and as an application to scorpion stings and ulcers; he also states that it is an ingredient in warm plasters.

Herodotus (4, 71) notices it as an aromatic plant used by the Scythians for embalming. *κύπειρον* is mentioned in the Iliad (21, 351) and Odyssey (4, 603) and by Theophrastus in his fourth book; it appears to have been a favourite food of horses. Pliny (21, 18) calls it *Juncus triangularis* or *angulosus*; it is also probably the Juncus of Celsus (3, 21), mentioned as an ingredient in a diuretic medicine for dropsy, although he calls it *Juncus quadratus*.

Description.—Culms erect, 1—2 feet, triangular, with rounded angles; leaves radical; sheathing shorter than the culms; root tuberous, tubers often crowded together, size of filberts, brown or black externally, white internally, odour like that of Acorus; umbels terminal, compound; involucre 3-leaved, unequal; spikes linear, sub-sessile. Often a troublesome weed in cultivated ground.

CYPERUS SCARIOSUS, *R. Br.*

Fig.—*C. B. Clarke, Linn. Soc. Journ. xxi.*, 159.

Hab.—Damp places in Bengal. The tubers.

Vernacular.—Nágar-motha (*Hind.*, *Guz.*), Nágar-mutha (*Beng.*), Lavála, Nágar-motha (*Mar.*), Muttah-kách (*Tam.*), Kola-tunga-muste (*Tel.*), Konnari (*Can.*).

History, Uses, &c.—This plant produces the aromatic tubers which have long been in use in Hindu medicine and perfumery under the Sanskrit name of Nágar-mustaka; they are considered to have the same medicinal properties as those of *C. rotundus*. Arabian and Persian writers mention this Indian Cyperus, but consider it to be inferior to *C. rotundus*. In the Concan, Nágarmoth, *Solanum indicum*, *Tinospora cordifolia*, Ginger and Emblic myrobalans, of each 2 tolás, are powdered and divided into 5 parts, and one part taken daily in decoction with a little honey and long pepper as a febrifuge. Several other prescriptions of a similar nature are used in fever, and will be found in the *Wanaushádi Prakasha.* In dysentery, Nágarmoth, Mocharas, Lodhra, Daitiphul (*Woodfordia floribunda* flowers), unripe Bael fruit, and the seeds of *Holarrhena antidysenterica* are ground with whey and molasses and given in 6 massa doses. In famine seasons Nágarmoth has proved a valuable resource to the poor.

Description.—The ovoid tubers of this plant are developed upon a thin underground stem, and are simple or branched, generally about 2 inches long and ½ an inch in diameter; the external surface is marked by a number of annular ridges, and is almost concealed by the remains of leaves; when these are removed, the colour of the tuber is a deep brown; a few wiry rootlets arise from its under surface, and at the lower end is a portion of the underground stem. The substance of the tuber is hard and of a reddish colour; it is divided into a central and cortical portion, the latter being of a darker colour. The odour is strongly aromatic like Acorus, but somewhat terebinthinate. The plant is aquatic and grows in the Concan in ponds and ditches along with *Scirpus subulatus*, Vahl.; both plants are called Lavála in Marathi, a name which appears to be equivalent to the English *Rush*.

Microscopic structure.—The outermost layer of the cortical portion is composed of large bundles of reddish-brown stony cells, separated from one another by interspaces; within it are from 6 to 8 rows of very thick-walled, empty cells; next a tissue of thick-walled cells, most of them full of large starch granules, but some containing essential oil and probably resinous matter. The central portion of the tuber is separated from the cortical by a single row of small yellow stone cells; it is composed of thick-walled cells full of starch like those in the cortical portion, but differs from it, inasmuch as many of the cells contain red colouring matter. Large vascular bundles abound in the root, some of them are surrounded by a layer of stony cells.

Commerce.--Two kinds of Nágarmoth are met with in this market – Surat and Kattiawar; the first is heavier and more aromatic than the second. Value—Surat, Rs. 2 per maund of 37½ lbs.; Kattiawar, Rs. 1¼. The Surat Nágarmoth is probably obtained from Rájputana, where the plant is common in tanks.

Scirpus Kysoor, *Roxb.* *Vern.*—Kasírú (*Hind.*), Kachara (*Bomb.*). The tuberous root found in tanks, about the size of a nutmeg, and of a black colour externally, has astringent properties, and is given in diarrhœa and vomiting.

We have met with two other species of Cyperus, yielding edible tubers. The one, called "Thegi" in Guzrathi, is probably *C. bulbosus*. It grows in the sand on the coast of Kattiawar, and is used as a bread-stuff at all times, and was of much value in the last famine. The tubers are ovoid and pointed, about ¼ of an inch in length, horny and translucent, brittle when dry and farinaceous when powdered. The other is called "Pudhya" in Marathi; it grows in salt rice-fields, and is eaten in the Southern Concan. The tubers are half an inch or a little more in length, surface brown, with the remains of membranaceous sheaths arising from four transverse rings, hard, white and mealy within.

The analyses of these tubers gave the following results :—

	Thegi.	Pudhya.
Fat	·73	·65
Sugar, &c. (spirit extract)	·82	1·64
Gum and carbohydrates	9·00	5·69
Albuminous matter	6·68	8·68
Starch	62·99	66·24
Fibre	6·78	4·51
Ash	3·60	2·06
Moisture	10·40	10·53
	100·00	100·00

The amount of nitrogen in the first was 1·07 per cent. and in the second 1·39 per cent. There were traces of an alkaloid in both tubers.

KYLLINGIA MONOCEPHALA, *Linn.*

Fig.—*Rheede, Hort. Mal. xii., t.* 53 ; *Rumph. Amb. vi.*, 8, *f.* 2 ; *Rottl. Gr.*, 13, *t.* 4, *f.* 4.

KYLLINGIA TRICEPS, *Linn.*

Fig.—*Rheede, Hort. Mal. xii., t.* 52.

Hab.—Throughout the Peninsula of India. The roots.

Vernacular.—Nirbisi (*Hind.*), Sveta-gothúbi, Nirbishi (*Beng.*), Mottenga, Pee-mottenga (*Mal.*), Musta (*Mar.*).

History, Uses, &c.—These plants are the Nirvisha of Sanskrit medical writers, who describe them as antidotal to certain poisons. Rheede describes *K. triceps* and *K. monocephala* as having similar properties, and states that the former plant is called *Coquinha* by the Portuguese. In Malabar a decoction of the roots is used to relieve thirst in fevers and diabetes, and oil boiled on the roots to relieve pruritus of the skin. He also states that they distil an oil from the roots, which is of a dark yellowish-green colour, pleasant odour and pungent taste, and which is used for the same purposes as the decoction and to promote the action of the liver.

Irving states that *K. monocephala* is used at Ajmere as an antidote like zedoary, and Roxburgh notices its use as an antidote in Bengal.

These plants have the odour, and apparently all the qualities, of *Cyperus rotundus*.

Description.—The roots are creeping, those of *K. triceps* bear tubers. The culms are erect and triangular, leafy at the base. The leaves membranaceous, flat towards the apex, ciliated with minute bristles on the margin and keel. The flower-heads of *K. monocephala* are solitary, globose, dense and white; whilst those of *K. triceps* consist of from 3 to 6 spikes, one of which is much larger than the rest. The involucres are 3 to 4 leaved, unequal, the longest leaf as long as the culm.

GRAMINEÆ.

ANDROPOGON SCHŒNANTHUS, *Linn.*

Fig.—*Royle, Ill., t.* 97; *Trin. Sp. Gr. iii., t.* 327. Russa grass, Ginger grass (*Eng.*), Schænanthe des Indes (*Fr.*).

Hab.—Indian Peninsula, Western Ghauts, extending sparingly to the coast. The essential oil.

Vernacular.—Sugandha rosá, Rusá, Gandhis, Gandhbel, Mirchiya gandh (*Hind.*, *Guz.*), Agiyá-ghás, Gandha-bena (*Beng.*), Sugandhirohisha, Rohishe-gavat (*Mar.*), Parimalada-ganjani (*Can.*), Sakanárú-pillú (*Tam.*).

History, Uses, &c.—This grass is the Bhustrina or Bhutrina "earth grass" of the Raja Nirghanta, and is also known as Rohisha in Sanskrit. Among the synonyms which it bears, we may mention Gandha-khéda and Gandha-trina "odorous grass," Su-rasa "well flavoured," and Su-gandha "having an agreeable odour." It is described as aromatic and stimulant and useful in bilious and phlegmatic affections.

Mahometan writers upon Indian Materia Medica confound *A. Schœnanthus* with Izkhir (*A. laniger*), and Mir Muhammad Husain gives *Rús* as an Indian name for Izkhir; he also mentions several other Indian names, such as Gandhis, Gandhbel, &c., showing that he was well acquainted with Rúsa grass. The author of the *Tuhfat-el-muminin* mentions a distilled water prepared from Izkhir, and also an oil made by macerating the grass in sweet oil exposed to the sun; it is therefore probable that in his time (1669) the essential oil was not made from *A. Schœnanthus*. The industry probably commenced in the 18th century whilst Khandesh was in a flourishing condition under its Mahometan rulers.

A. Schœnanthus was first brought to the notice of Europeans by General Martin, who collected the seeds in the Balaghat, during the war with Tippu Sultan, and cultivated the plant at Lucknow, whence he sent seeds to Roxburgh, in Calcutta. The first mention of the oil is by Maxwell in 1825 (*Calcutta Med. Phys. Trans.*, i., p. 367); it was afterwards described by Forsyth, 1827 (*Ibid.*, iii., p. 213). The *A. Nardus* of Ainslie, which he calls ginger or spice grass, is doubtless the same plant; he notices its use in infusion as a stomachic, and states that an essential oil is prepared from it which is useful in rheumatism.

Preparation of the oil.—The oil distillers in Khandesh call the grass *Motiya*, when the inflorescence is young and of a bluish-white colour; after it has ripened and become red, it is called *Sonfiya*.* The oil obtained from it in the first condition has a more delicate odour than that obtained from the ripened grass. The Motiya oil is usually mixed with the seçond kind, which by itself would not fetch a good price in the European market. The grass grows freely, though not very widely, on open hill-sides in West Khandesh, especially in Akráni. The original seat of the manufacture was Pimpalner, but as the oil is in great demand, the manufacture has of late spread to Nandurbár, Sháháda, and Taloda. The makers are Musalmans, who, at the close of the rains, about September, when the grass is ripening, buy it from the Bhils, stack it, and set furnaces at the sides of brooks where wood and water are plentiful. A large pit, four feet long by two wide and two and a half deep, is dug, and a furnace (*chula*) prepared. On this furnace is placed a copper or iron caldron, large enough to hold from 30 to 50 pots of water. After pouring in some water, the caldron is filled to the brim with chopped grass, and a little more water is added. The mouth of the caldron is carefully closed with an iron or copper plate, made fast with wheat dough. From a hole in this lid, a bamboo tube, wrapped in a piece of cloth, plastered with the flour of *Udid* (*Phaseolus Mungo*, Linn., black var.), and bound with ropes, passes into a second closed caldron, sunk to the neck in running water. The steam from the grass is condensed in the second caldron, which, when full, begins to shake. The tube is then skilfully removed, and the contents of the caldron poured into a third similar vessel and stirred. Then the oil begins to appear on the surface, and is slowly skimmed off. The distillate is returned with fresh grass to the still. In 1879-80 the number of stills was 197, producing about 71 cwts. of oil. More than 100 stills are worked in Nandurbár alone, and the increase of the manufacture is prevented only by the scarcity of the grass. The oil is packed in skins, and sent on bullock back over the Kundaibári Pass to Surat, and by Dhulia and Manmad to Bombay.

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* We are indebted to Mr. A. Lucas, Assistant Collector, Khandesh, for specimens of the Motiya and Sonfiya grasses from the distilling districts.

We are assured by the Bombay dealers that all the oil of commerce is more or less adulterated; and a comparison of the commercial article with some oil distilled by one of us supports this statement; the adulteration is said to be practised by the distillers, who, we are informed, are regularly supplied with oil of turpentine from Bombay. 373 lbs. of grass received from Khandesh and submitted to distillation under our own superintendence in Bombay yielded 1 lb. 5½ ozs. of oil. Portions of this oil were mixed with oils of turpentine, groundnut, rape, and linseed; with all three it formed a milky or turbid mixture, but the two first, after standing for some days, became perfectly bright. We are informed that formerly it was the custom to adulterate with groundnut oil, but that turpentine is now used, as it cannot be detected by the evaporation test.

The use to which Rúsa oil is put in Turkey, to which country it is principally exported, *viâ* Egypt and the Red Sea ports, from Bombay, was first explained by Hanbury (*N. Repert. f. Pharm.*, viii., 365), and in *Pharmacographia* we find the following interesting statement:—"No drug is more subject than attar of rose to adulteration, which is principally effected by the addition of the volatile oil of an Indian grass, *Andropogon Schœnanthus*, L. This oil, which is called in Turkish *Idris yaghi*,[*] and also *Entershah*, and is more or less known to Europeans as *Geranium oil*, is imported into Turkey for this express purpose, and even submitted to a sort of purification before being used.[†] It was formerly added to the attar only in Constantinople, but now the mixing takes place at the seat of the manufacture. It is said that in many places the roses are absolutely sprinkled with it before being placed in the still."

Description.—Root perennial, with long wiry fibres; culms erect, from 3 to 6 feet high, often ramous, smooth, filled with a spongy pith; leaves very long, tapering to a very fine point, smooth in every part, and of a soft delicate texture; sheaths, shorter than the joints on full-grown plants, with a membranaceous stipulary process at the mouth; panicles linear, subsecund; spikelets paired, but with only three joints; flowers also paired, one-awned, hermaphrodite and sessile, the other, awnless, male and pedicelled, the terminal florets are three, one hermaphrodite, sessile and awned, the other two male, pedicelled, and awnless.

Hermaphrodite calyx one-flowered, two-valved, base girt with wool, as is also the rachis and proper pedicels; corol one-valved, a long black awn occupies the place of the other, which has two small filaments at its base; nectary two minute leaflets embracing the germ laterally; stamens, pistil, and seed as in the genus.

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[*] عضرس, izris, pronounced *idris* by the Arabs, is a Persian word, and is explained in the *Burhán* as a kind of wild mallow which the Greeks call *Aluba* and the Arabs شحم لمراج (shahm-el-maraj). If a decoction of it with vinegar and oil is rubbed on the limbs it protects against venomous bites. It is perhaps *Pavonia odorata* or some other odoriferous plant belonging to the Malvaceæ.

[†] For particulars, see Baur (p. 262, note 3).

Male calyx as in the hermaphrodite; corol one-valved; nectary and stamens as in the hermaphrodite, no pistil. (*Roxburgh.*)

The oil of *A. Schœnanthus* distilled by one of us was dextrogyre, the ray being rotated 39° to the right by a column of 100 mm., and 78° by one of 200 mm. Some samples of the commercial oil rotated the ray about 13° to the right, and others had little or no effect upon it. The colour of the genuine oil was that of pale sherry; the commercial samples were more highly coloured. The odour at first resembles that of the rose, but there is a persistent and terebinthinate after-flavour which is not agreeable.

The taste is pungent and agreeable, approaching that of ginger.

Chemical composition.—The oil of this grass, which has been named *Geraniol* ($C^{10}H^{18}O$), is an alcohol belonging to the series $C^nH^{2n}—^2O$. The two samples examined by F. W. Semmler (*Ber. d. D. Chem. Ges.*, 23, 1098), which yielded 90 per cent. of geraniol, must have been adulterated, as they turned a ray of polarised light 20° to the left, whereas the genuine oil distilled by one of us was strongly dextrogyre. Geraniol, which occurs also in *Pelargonium Radula*, Aiton, has a fragrant odour of roses, and is miscible with alcohol and ether; the boiling point at 17 mm. pressure is 120°·5—122°·5, and the refraction 48·71. With calcium chloride at 50° it forms a crystalline compound ($C^{10}H^{18}O$) $Ca\ Cl^2$, decomposed by water and slowly oxidised by air. Potash-fusion forms isovaleric acid. Neutral aqueous $K^2M_nO^4$ forms acetic and isovaleric acids. Even boiling baryta-water slowly forms isovaleric acid. Chromic acid mixture forms citral (*Semmler*). HNO^3 forms nitrobenzene, HCy, oxalic acid, and a resin, but no camphoric acid. (*Beilstein Chemie*, iii., 265; *Watts' Dict. Chem.*, 2nd Ed., ii., p. 609; *Ber. v. Schimmel & Co.*, April 1891, p. 37.)

In medieval Europe it was officinal under the names of Schœnanthus, Squinanthus, and Juncus odoratus, and was also known as Fœnum vel stramen camelorum "camel's hay or straw," from its being the principle food of camels in the deserts between Syria and Egypt. In Arabia, under the name of *ghusúl*, the powdered grass is still used as a perfume for the bath.

Description.—This grass is distinguished by its simple rhizome, short thick tuft of radical leaves, and lanigerous calyx. The odour is like that of oil of Rhodium; the taste aromatic, bitter, and somewhat acrid.

Chemical composition.—From 56 lbs. of the dry grass purchased in the bazar we obtained the large yield of 8¾ ozs. of essential oil; it had a specific gravity of ·905 at 85° F., and rotated a ray of polarized light 8·0 degrees to the left in column 200 mm. long. The colour was that of pale sherry. According to Schimmel & Co., the essential oil reminds one of the odour of Elemi oil. Its sp. gr. is ·915, the optical rotation +34° 38′. It boils between 170° and 250°, and contains phellandrene (*Bericht von Schimmel & Co.*, April, 1892).

ANDROPOGON CITRATUS, *DC.*

Fig.—*Wall. Pl. As. Rar. iii., t.* 280; *Rheede, Hort. Mal. xii., t.* 72. Lemon grass (*Eng.*), Chiendent-citron (*Fr.*).

Hab.—Eastern Archipelago? Cultivated throughout India. The herb and oil.

Vernacular.—Ágya-ghás, Agin-ghás (*Hind.*), Gandha-bena (*Beng.*), Hirva-chaha, Olen-chaha (*Mar.*), Lili-chahe, Nili-chahe (*Guz.*), Váshana-pulla (*Tam.*), Nimma-gaddi, Chippa-gaddi (*Tel.*), Vásana-pulla, Sambhára-pulla (*Mal.*), Purváli-hullu Vásane-hullu (*Can.*), Pengrima (*Cing.*).

History, Uses, &c.—This grass is not mentioned to our knowledge by any of the Hindu or Mahometan writers upon Indian medicinal plants. It was observed by Van Rheede early in the 17th century as an established and well-known cultivated plant, and it is not improbable that Hindu colonists returning from Java may have introduced it. The Hindus colonized that island in the 5th century, and in the 7th century there was much intercourse between the mother-country and the colony. In Java the grass is called Sireh; it was known to Rumphius and other early writers on the natural history of the East, and in 1717 an oil distilled from it in Amboyna was known as a curiosity. (*Ephem. Nat. Curios.*, cent. v—vi., Appendix 157, quoted in *Pharmacographia.*) Lemon-grass oil is mentioned by Roxburgh in 1820 as being distilled in the Moluccas, and it was first imported into London about the year 1832. An infusion of the fresh herb is a favorite native remedy in India as a diaphoretic and stimulant in catarrh and febrile-conditions, and also in the congestive and neuralgic forms of dysmenorrhœa. The oil is used as a carminative and as an application in chronic rheumatism. The oil has been made official in the *Pharmacopœia of India.* Dr. Waring, in the appendix to this work, records a high testimony in its favour both as an external application in rheumatism and in other painful affections, and as a stimulant and diaphoretic internally. He states that amongst the half-castes of South India it is one of their most highly esteemed remedies in cholera. In infusion the leaves are often combined with tea, mint, or black pepper. The oil is distilled in rude stills at the Western base of the hills in Travancore, from Anjengo northwards. The grass is burnt at the end of the dry weather. In Europe the oil is now a well-known article of commerce under the names of Lemon-grass oil, Oil of Verbena, and Indian Melissa oil. It is employed as an ingredient in perfumes, such as Eau de Cologne, and for scenting soaps, and also for adulterating the "true Verbena oil" obtained from *Lippia citriodora* in Spain.

Description.—Root perennial, young propagating-shoots issue from the axils of the leaves that surround a short, subligneous leaf-bearing culm. Culms from 5 to 7 feet high, erect, simple, smooth, about as thick as a goose-quill. Leaves many, near the root bifarious, few on the upper part of the culm, of a soft texture, pale-green colour, slightly scabrous on the margins, otherwise smooth; from 3 to 4 feet long, including their sheaths, and about ¾ of an inch broad. Floral leaves small. Panicle linear, a little bent to one side, composed of many fascicles of spikes that are both terminal and form the exterior axils. Spikes generally paired on a common peduncle, with a common boat-like spathe, or involucre at the division; each has also its proper pedicel, and both spathe-shaped. Rachis articulated, much waved, hairy. Flowers in pairs, one hermaphrodite and sessile, the other male and pedicelled; the last hermaphrodite flower of each spike has two males; below there is only one male, as the rachis occupies the space of the other. Hermaphrodite flowers sessile. Glume girt at the base with wool. Corol 2-valved, awnless. Nectary, two, broad, short, wedge-formed, obliquely lobed, crenulated bodies embrace the insertion of the filaments and the forepart of the germ. Male flowers pedicelled, calyx, glumes as in the hermaphrodite ones. Corol 1-valved, awnless. Nectary as in the hermaphrodite, stamens three. This grass flowers in the rains, but rarely.

Chemical composition.—The most interesting constituent of this oil is *Citral*, which has been examined by J. W. Semmler (*Ber. d. Deutsch. Chem. Ges.*, 23, 3556, and 24, 203). This author found that the aldehyde $C^{10}H^{16}O$, obtained by the oxidation of geraniol with chromic acid mixture, is identical with the citral of oil of lemons. By further oxidation with argentic oxide he prepared *Geranic acid*, $C^{10}H^{16}O^{2}$, a limpid oil, and by treating citral with acid sulphate of potassium, *Cymol* was formed, a molecule of water splitting off.

Up to the present time citral has been found by Messrs. Schimmel & Co. in the following essential oils:—

Lemon oil	from	*Citrus Limonum.*
Limetta oil	,,	*Citrus Limetta.*
Mandarine oil	,,	*Citrus Madurensis.*
Lemon grass oil	,,	*Andropogon citratus.*
Eucalyptus oil	,,	*Eucalyptus Staigeriana.*
Backhousia oil	,,	*Backhousia citriodora.*
Citronella fruit oil	,,	*Tetranthera citrata.*
Japan pepper oil	,,	*Zanthoxylon piperitum.*

Commerce.—The oil is largely exported from Singapore and Ceylon, where the grass is cultivated. The shipments from the Malabar Coast during the last four years were as follows:—1887, 943 cases; 1888, 1,678 cases; 1889, 979 cases; 1890, 1,610 cases. The exports from Cochin have risen from 228 cases in 1884 to 2,387 cases in 1889 and 1,917 cases in 1890. A case contains 12 bottles of oil, and is priced at Rs. 18½. A bottle is guaranteed to hold 23 ounces of oil.

ANDROPOGON NARDUS, *Linn.*

Fig.—*Bentl. and Trim.*, *t.* 297. Citronelle grass (*Eng.*).

Hab.—Ceylon, Travancore, cultivated at Singapore. The essential oil.

Vernacular.—Maana (*Cing.*).

History, Uses, &c.—This grass is considered by some botanists to be the wild form of *A. citratus.* Other grasses closely allied to it are *A. Khasianus,* Munro, growing in Silhet, and *A. distans,* Nees, growing in the North-West Provinces and in parts of the Bombay Presidency, but no oil has ever been distilled from these species, nor do they appear to be used medicinally by the natives.

A. Nardus is not mentioned in any Sanskrit medical work, nor do the Arabian and Persian medical writers notice it. It owes the name *Nardus* to its having been confounded with *A. laniger,* which was named νάρδος by the Greeks who invaded India. At the present time it is only known in Southern India and Ceylon, and the Hindi names which have been ascribed to it in the *Dict. Econ. Prod. of India* properly belong to *A. Schœnanthus* or *A. citratus.*

Description.—A large perennial herb, with a long slightly branched, partly aërial rhizome, reaching ½ inch in diameter, and strongly ringed with the closely-placed scars of the leaf-sheaths, the remains of which persist on the upper portion, and giving off numerous tough root fibres. Stem reaching 6 feet or more high, erect, stout, cylindrical, solid, smooth and shining, partially concealed by the leaf-sheaths, scarcely thickened at the nodes, which are approximated below, but widely separated above, flat or channelled on one side in the upper portion. Leaves very large and long, numerous, erect, lower ones sometimes reduced to their sheaths; sheaths thick and strong, about 6 inches long, closely but not entirely enveloping the stem, quite smooth, striate; ligule short, brown, laciniate, scarious; blade about 2 feet long, linear, very much attenuated at the apex, tapering below, minutely denticulate with forward points on the edges, smooth on both surfaces, pale somewhat glaucous green, lighter beneath. Spikelets very small, arranged in couples, one-stalked, containing one male flower, the other sessile, with one hermaphrodite and often one barren flower; the couples, to the number of 3 or 4, articulated on alternate sides of a short, flattened, jointed rachis clothed along the edges with long white silky hairs tufted beneath the spikelets, forming a short acute spike about ½—¾ inch long; the spikes arranged in pairs on a common slender stalk, at the bent basal node of which is a large, erect, acute, leafy, striate, orange-red, shining bract, scarious at the edges, which encloses the pairs of spikes before expansion; the pairs of spikes very numerous, placed on the somewhat zic-zac, elongated, smooth, slender, erect, flattened branches of elongated panicles, which come off in clusters from the axils of the upper leaves, the whole forming a very large tufted, elongated somewhat drooping inflorescence, often 2 feet or more in length; glumes nearly equal, acuminate, membranous, smooth, purplish, boat-shaped, the lower one of the sessile spikelet flattened on the back against the rachis and without a mid-rib, those of the stalked spikelets with several parallel strong veins; pales of the lower spikelet 2, or with a third representing a barren flower, very unequal, the lower very small, deeply bifid with two long cusps, from between which comes off a long, slender, slightly kneed purple awn, about twice the length of the glumes, and projecting considerably beyond the spikelet, the upper much larger, acute but without an awn, very delicate and membranous, without veins; in the flower of the upper spikelet there is but a single membranous non-awned pale. Lodicules 2, oblong, truncate, longer than the ovary. Stamens 3, anthers purple. Stigmas 2, spreading, protruded from the flower, plumose, bright red-purple. Fruit not united with the pales. (*Bentley and Trimen.*) The oil is of a pale yellow colour when pure. Mr. J. C. Umney (*Pharm. Journ.*, Ap. 11, 1891, p. 922) has shown that the green colour of the commercial oil is due to the presence of copper. According to Messrs. Schimmel, the sp. gr. should not fall below ·895 at 15°C. The oil is often adulterated with petroleum.

Chemical composition.—E. Kremers (*Proc. Am. Pharm. Assoc.*, 1887, p. 562) found the oil to consist of an aldehyde ($C^7H^{14}O$), a terpene ($C^{10}H^{16}$), an isomer of borneol, named Citronellol, and acetic and valeric acids. These two acids are said to be formed through the oxidation of the aldehyde and to exist originally in combination with citronellol as a compound ether. T. D. Dodge (*Am. Chem. Journ.*, 1889, p. 456) obtained somewhat different results. The aldehyde, isolated from the oil by means of a concentrated solution of sodium bisulphite, according to Kremers is $C^7H^{14}O$, while Dodge obtained results corresponding to $C^{10}H^{18}O$, and names the compound *citronellic aldehyde.* By the action of P^2O^5, an oily product, probably a terpene, was obtained. By heating the dibromide of the aldehyde the distillate contained a small quantity of oil having the odour of cymene, $C^{10}H^{14}$, thus confirming the statement of C. R. A. Wright (*Journ. Chem. Soc.*, 1875, p. 1). Oxidation with potassium permanganate yielded a mixture of fatty acids smelling strongly of valeric acid. A portion of the oil boiling at 77° C. was probably a terpene. The portion boiling at 222° C., probably *citronellyl alcohol,* $C^{10}H^{20}O$, the same as obtained by the reduction of citronellic aldehyde, the acetyl derivatives of both having the same characteristic rose-like odour.

ANDROPOGON ODORATUS, *Lisboa.*

Fig.—*Journ. Bombay Nat. Hist. Soc. iv.*, p. 188.

Hab.—Western Ghauts, extending sparingly to the coast. The grass.

Vernacular.—Vaidi-gavat, Usadhana (*Mar.*).

History, Uses, &c.—This grass is not, to our knowledge, mentioned by Sanskrit writers, but is well known to the peasantry by the names given above, which signify "physician's grass" and "pungent grass." *A. odoratus* was first observed by one of us in 1875 as a grass growing sparingly at Tanna, near Bombay, and used by the natives as a carminative in the bowel complaints of children (*Mat. Med. of Western India*, 1st Ed., p. 693). In 1889 this grass was found growing abundantly at Lanowli on the Western Ghauts by Mrs. J. C. Lisboa, and was described and figured in the *Journal of the Bombay Natural History Society.* We have since distilled the grass and obtained from it an essential oil having at first an odour recalling that of cassia and rosemary, but afterwards a strong persistent odour of oil of cassia. Messrs. Schimmel & Co. notice the odour of Pine needle oil in this sample, and find the sp. gr. to be ·945.

Description.—Root as in *A. Schœnanthus.* Culm erect, 3—5 ft. high, sometimes branching from the lower part, glabrous; nodes long-bearded. Leaves lanceolate, cordate at the base, acute or acuminate, with a few long hairs; the lower cauline and radicle leaves long, the upper small, but their sheaths very long. Ligula small. Spikes numerous, erect, branched, pedicellate (the pedicel of the lower spikes longer), and congested at the end of a long peduncle without a sheathing bract and forming an erect, dense, ovoid panicle. The rachis, pedicel, and the spikes covered with long silky hairs. Spikelets nearly two lines long, of a purple colour, the sessile and the pedicellate nearly similar; outer glume of the sessile spikelet rather thin, many-nerved, somewhat obtuse and covered with long silky hairs, with a pit in some spikelets of the same plant and absent in others; second glume as long as the first or a little longer, but broader, thin, and keeled; third glume thinner and hyaline; fourth glume, smaller or an awn ½—1 inch long, with a hermaphrodite flower at the end of the pedicel. Pedicel of the pedicellate spikelet covered with white hairs, but the spikelet almost free of hairs. Outer glume stiff, with five or more nerves, not prominent, almost obtuse; second glume thinner, with three nerves, somewhat broader, but as long as the first; third glume hyaline, smaller; fourth glume very small, hyaline or none; no awn; at the top of the pedicel three stamens not well formed and not as large as in the hermaphrodite flower. (*J. C. Lisboa.*)

The yield of oil from the grass was equal to that obtained from *A. Schœnanthus*; it had a deep sherry colour, a specific gravity of ·931 compared to an equal volume of water at 84° F., and a rotatory power of —22·75 in a column of 100 mm. or $(\alpha)^D = -24{\cdot}43$.

ANDROPOGON MURICATUS, *Retz.*

Fig.—*Beauv. Agr., t.* 22. Cuscus (*Eng.*), Vettivér (*Tam.*), Chiendent des Indes (*Fr.*).

Hab.—Coromandel, Mysore, Bengal, Northern India. The roots.

Vernacular.—Khas, Bála, Panni (*Hind.*), Khaskhas, Bená (*Beng.*), Vála, Várélu (*Mar.*), Válo, Khaskhas (*Guz.*), Vettivér (*Tam.*), Vattivéru (*Tel.*), Báladvéru (*Can.*).

History, Uses, &c.—The root of this grass, which is the only part of the plant having aromatic properties, is described in the Nighantás under the name of Usíra, and bears among other synonyms those of Virana, Véni-mulaka "having braided roots," Sugandhi-mulaka "having sweet-smelling roots," Sita-mulaka "having cool roots," &c. It is considered to be cooling, refrigerant and stomachic, removing bile and phlegm, and useful to allay thirst in fever and inflammatory affections. An infusion is used, and it enters into the composition of several cooling mixtures. Sir W. Jones suggests that it is the *Mrinála* mentioned in Kalidasa's *Sakuntala*, but that name is more commonly applied to the leaf-stalk of the Lotus than to the roots of this grass. All parts of the Lotus are renowned for their cooling properties, and the use of the Water Lily for Sakuntala's complaint appears to us to be more poetical. In Vedic times the ancient Hindus were instructed to build their houses in a place where the Virana and Kusa were abundant, and on some copper-plate inscriptions discovered near Etawah, dated A.D. 1103 and 1174, this plant is mentioned as one of the articles upon which the kings of Kanauj levied imports (*Proc. As. Soc. Bengal*, 1873, p. 161). Externally it is used in a variety of ways: a paste of the root is rubbed on the skin to relieve oppressive heat or burning of the body; an aromatic cooling bath is prepared by adding to a tub of water the root in fine powder, together with the root of *Pavonia odorata*, red sandalwood and the wood of *Prunus Puddum*. The same ingredients are applied in the form of a thin paste to the skin. (*Chakradatta.*)

All over India the roots are made into aromatic scented mats, hung in door-ways, and kept wet to cool and perfume the atmosphere during the hot season; they are also much used for making fans, ornamental baskets, and other small articles. When distilled with water, the roots yield a fragrant oil, which is used as a perfume and for flavouring sherbet. Mir Muhammad Husain, in the *Makhzan-el-Adwiya*, describes *khas* as a kind of Izkhir used in India, known as Izkhir-i-Jámi and called by the Persians Bikh-i-wála. European physicians in India have used the root as a diaphoretic, and Pereira (*Mat. Med.*, ii., Pt. I., p. 132) states that in 1831 it was used in Paris and Hamburg as a preservative against cholera, being hung up in rooms and burnt as a fumigatory. In 1837 it was recommended by Foy in rheumatism and gout. At the present time the root is distilled in Europe to obtain the oil. which commands a high price, being used in the composition of many favourite perfumes, as "Mousseline des Indes," "Maréchal," "Bouquet du Roi," &c.

Description.—*A. muricatus* has an erect compressed culm, 5 to 6 feet high, with smooth nodes and linear-narrow sub-bifarious rigid elongated leaves; the panicle is verticelled; the branches are very numerous, simple and spreading; the joints of the rachis are smooth; the glumes are minutely prickly on both sides, sub-equal, muricated. The radicles are very numerous and spring from a rhizome, on the upper surface of which are leaf-buds. The entire root is of a yellowish-brown colour, and has a strong and persistent odour, somewhat like myrrh ; the taste is bitter and aromatic.

Chemical composition.—Khaskas has been analysed by Vauquelin, who has obtained from it a resinous substance of a deep red-brown colour, having an acrid taste and an odour like myrrh ; a colouring matter soluble in water ; a free acid ; a salt of lime ; a considerable quantity of oxide of iron ; a large quantity of woody matter. (*Annales de Chimie,* lxxii., p. 302.) The oil is difficult to extract; this difficulty may be overcome by placing the roots in a steam-jacketted still with just sufficient water to drench them, allowing to stand for a short time, and then admitting steam at about 15 lbs. pressure into the jacket, when a light oil will come over. A current of steam afterwards admitted into the still and raised to 25 lbs. pressure will bring over the heavier portion of the oil. Piesse states the yield to be 10 ozs. per cwt.

COIX LACRYMA, *Linn.*

Fig.—*Bot. Mag., t.* 79; *Rheede, Hort. Mal. xii., t.* 70. Job's tears (*Eng.*), Larmes de Job (*Fr.*).

Hab.—Plains of India and warm hill-slopes from the Punjab to Burma. Cultivated on the hills. The seeds.

Vernacular.—Sankhru, Sankhlu, Gargari-dhàn (*Hind.*), Gargar, Kunch (*Beng.*), Rán-jondhala, Rán-makai (*Mar.*), Kasái (*Guz.*).

History, Uses, &c.—The different species of Coix bear the Sanskrit names of Gavídhuka, Gavedhu, and Gavedhuka. They are mentioned in Vedic literature, and appear to have been one of the cereals which were cultivated by the Arians on the hill-slopes of the Himalayas. They are still cultivated by the hill-tribes in the Khasia and Naga Hills and in Assam and Burma, where they are known by the vernacular names of Kasi, Kulésé, Kalinsi, Kyeit, &c., and are used as a food-stuff. The wild form, common in the plains, is only used for medicinal purposes, and is considered to be strengthening and diuretic. The Arab travellers in the East became acquainted with the seeds and named them Damu Dáud "David's tears," and afterwards Damu Ayúb "Job's tears." Es-Ságháni, who died about the year 1260, mentions them in the *Obáb* as a well-known strengthening and diuretic medicine. The Arabs introduced the plant into the West, and it has become naturalized in Spain and Portugal, where it is still known as *Lagrima de Job.* European botanists have rather inappropriately given the name of Coix (Greek κοιξ) to this genus, Coix being the name of a kind of palm growing in Africa and mentioned by Theophrastus and Pliny.

The following notice of *C. lacryma* occurs in the *Descriptive Catalogue of the Vienna Exhibition*, 1873 :—" The seeds known as Job's tears are used as food in China and Malacca, under the name of Eejin or Ee-yin. 'It is,' we are told, 'the most remarkable among food-grains for its chemical composition.' Dr. Smith writes that 'it is larger and coarser than pearl-barley, but it is equally good for making gruel. As it is sold for five pence per Chinese pound, it makes an excellent diet-drink for hospital patients in China.' Dr. Hooker observes that 'a great deal of Coix is cultivated in the Khasia Hills; the shell of the cultivated sort is soft and the kernel is sweet, whereas the wild Coix is so hard that it cannot be broken by the teeth; each plant branches two or three times from the base, and from seven to nine plants grow in each square yard of soil; the produce is small, not above 30 or 40 fold.' In Mason's '*Burmah*' it is stated that a species of Coix, with large esculent seeds, which are parched like Indian corn, are often for sale in the bazars, and are cultivated very extensively by the Red Karens."

C. lacryma has also been introduced into Brazil, where it is cultivated to some extent. For much interesting information concerning the different species or varieties of the plant, and the economic uses to which the seeds are put, we must refer the reader to the *Dict. Econ. Prod. of India*, ii., p. 492.

Description.—The silicious involucre of this grass containing the seed is sold in the drug shops. It is about the size and has much the appearance of a small cowrie shell, shining white, and very hard. At the base is a scar marking the attachment of the peduncle; at the apex an opening, from which, even in the dry state, a portion of the female flower may be seen protruding. In the fresh state a spike of male flowers, from one to two inches long, rises from it.

Chemical composition.—Church (*Food Grains of India*) found the edible grain, separated from the husk, to contain water 13·2, albuminoids 18·7, starch 58·3, oil 5·2, fibre 1·5, ash 2·1 in 100 parts. Peckholt, who examined the seeds grown in Brazil, ascertained that 1000 parts afforded (among less important constituents) fatty oil 6·6, resin 3, sugar 7, starch 84, husks and shell 696 parts. (*Cat. of the Exhibition of* 1866 at *Rio de Janeiro.*)

ERAGROSTIS CYNOSUROIDES, *Rom. et Sch.*

Fig.—*Delile, Descr. de l'Egypte, t.* 10; *Rheede, Hort. Mal. xii., t.* 57.

Hab.—Throughout the plains of India. The herb.

Vernacular.—Kusa, Darbha (*Hind.*), Kusha (*Beng.*), Darbha, Kusha (*Mar.*).

History, Uses, &c.—In Hindu ritual the Kusa occupies much the same position as the Durva and Tulasi. Among the synonyms for this grass are Darbha, Barhis "that which is plucked up," Suchy-agra "needle-pointed," Yajna-bhushana "ornament of sacrifice," Dirghapattra "having long leaves," Vajna "lightning," Suchi-mukha "needle-mouthed," Punyatrina "holy grass," &c. Its pointed leaves are used for the purification of sacred beverages, and spread beneath the sacrificer and the sacrifice, like the Vervein was amongst the Romans. In the Vedas this plant is often invoked as a god: "Thee, O Darbha, the learned proclaim a divinity not subject to age or death; thee they call the armour of Indra, the preserver of regions, the destroyer of enemies; a gem that gives increase to the field; at the time when the ocean resounded, when the clouds murmured, and lightning flashed, then was Darbha produced, pure as a drop of fine gold" (*Atharva Veda*). The Vedic rituals furnished instructions for its use. According to Ásvalayána, two pieces without knots were used for purifying butter—one was to be held in each hand between the thumb and the fourth finger, the second and third fingers being raised. Turning towards the East, Savitri, Vasu, and the Sun's rays were invoked. At the new and full moon they fasted and tied together Kusa and firewood, hence the name Kusákara for fire, the sacred fire being made upon a tuft of the grass. At the time of the first cutting of a child's hair, the father took a position to the south of the mother, and, holding in his hand twenty-one blades of the grass (to represent the twenty-one Maruts or winds), invoked Vayu, the god of wind. The father, or, in his absence, a Brahmin, then took three blades of the grass and thrust them, points foremost, into the child's hair, saying, "O herb protect him." The Vedic homestead was directed to be built in a place where the Kusa and Virana grew, its foundations were to be strewed with the grass, and all prickly herbs, as the *Apamarga*, the *Saka*, the *Tilvaka*, and the *Parivyádha*, were to be extirpated. When they learned the sacred books, students used to sit upon a spot of ground strewed with the Kusa, and on leaving they carried away, amongst other things, some blades of the grass as a remembrance and good omen. In the Brahmanic period the Kusa was used in invoking Vishnu; anchorites covered their nakedness with the grass, or with the skins of animals and bark of certain trees. In modern times it is in constant requisition in Hindu ceremonial, and at funerals the chief mourner wears a ring of the grass upon his finger, and it is placed beneath the *pîndas.* Brahmins place it in the hands of pilgrims when they bathe in the sacred Ganges. M. Sénart draws a comparison between the Vedic *Kusa* and the Beresman of the ancient Persians, and explains its significance in Buddhic ritual: it serves as a sacred prayer-carpet which is presided over by the divine Intelligence. As a medicine it enters into compound prescriptions for dysentery and menorrhagia, and is specially used as a diuretic. It is often confounded with *Cynodon dactylon* by the herbalists, or perhaps they consider both grasses to be equally efficient.

Description.—Root creeping, perennial. Culms straight, rigid, round, smooth, from 1 to 3 feet high. Leaves numerous, very long, chiefly about the base of the culms, rigid margins hispid. Panicle erect, linear-oblong, often tending to a conical form, composed of many somewhat threefold, verticelled, horizontal, short, rigid, secund ramifications. Spikelets many-flowered, depending, in two rows, from the under-side of the ramifications. Valves of corolla pointed, the inner one rather the largest.

CYNODON DACTYLON, *Pers.*

Fig.—*Eng. Bot. xii., t.* 850; *Fl. Græc., i., t.* 60. Creeping Dog's-tooth-grass (*Eng.*).

Hab.—Plains of India, westward to the south of England. The herb.

Vernacular.—Durvá, Dúb, Hariyáli (*Hind.*), Durba (*Beng.*), Durvá, Harala, Haryáli (*Mar.*).

History, Uses, &c.—This grass must have first attracted the attention of the ancient Hindus by its value as a food for their cattle. A modern Indian proverb says—Zamindári dúb ki jár hai (an estate like the roots of the Dúb, *i.e.*, is always bearing). The plant has many synonyms in Sanskrit, such as Granthi "knotted," Sveta "white," Bhárgavi "belonging to Sukra" (the regent of the planet Venus), Ruha "growing," Dur-mara "not easily dying," &c. Nanak Shah thus apostrophizes himself:—

> Nanak! nannhá ho raho jaisi nannhi dúb!
> Aur ghás jal jáengi, dúb khúb ki khúb.
>
> Be modest Nanak! as the fresh soft *Dúb* doth lowly lie,
> Whilst other grasses scorched up are, the *Dúb's* bloom ne'er doth die. (*Fallon.*)

In the *Rig-Veda* (x., 134) misfortunes are prayed to depart like the Dúrva whose seeds fall far from the plant; an allusion to the far-spreading habit of this grass, which has also given rise to the proverbial expression "Dúb ki nal" (the sheath of the Dúb) as applied to family connections, so called from their tendency to spread far and wide like the Dúb. Like other useful plants this grass was deified by the Hindus; in the *Atharva-Veda* it is thus addressed— "May Dúrva which rose from the water of life, which has a hundred roots and a hundred stems, efface a hundred of my sins, and prolong my existence on earth a hundred years." The Hindus believe that a benevolent Apsaras or nymph dwells in the plant, and when they build a house they place the grass on the four corners of the foundations. This practice dates from Vedic times.

Dúrva is also spoken of as Dúrveshtaka, from its being used in erecting an altar; it is sacred to Vishnu and Ganesha, and a festival called the Dúrváshtami is held in its honour on the eighth day of the light half of the month Bhadra; at this festival the male worshippers wear the grass tied to the right arm, and the females tied to the left. At marriages the right arm of the bridegroom is tied to the left arm of the bride with Dúrva; it is a phallic emblem, like the *fétu* or straw was in Europe. In the third act of the *Vikramorvasi* of Kálidasa, Urvasi shows herself to Purúravas with her hair decked with Dúrva, a symbol that she accepts his love. De Gubernatis says:—"A Pésaro, le jeune paysan, lorsqu'il désire demander en mariage la jeune fille qu'il aime, ôte du pailler un fétu de paille et, en le lui montrant, lui demande si elle veut entrer dans sa maison." According to Ásvaláyana and Náráyana, the husband, in the third month of his young wife's pregnancy, should squeeze the juice of the Dúrva into her right nostril to secure a male child; this practice is still customary in Western India and probably elsewhere. Dúrva is one of the eight ingredients of the *Arghya*, a respectful oblation made to gods and venerable men. The popular version of the *Ramayan* mentions the eight ingredients in the following couplet:—

Dahi, Dúrba, rochan, phal múlá
Nav tulsi dal, mangal múlá,

i.e., curdled milk, dúrba, rochan, flowers and roots, young leaves of the Tulsí and Lotus, turmeric.

According to the *Panchatantra*, Dúrva was born from the hairs of a cow; in a strophe quoted by Böhtlingk (*Ind. Spr.*, ii., 2921), the leaf is described as the ornament of the Dúrva, like the flower of the tree, independence the ornament of man, and the husband the ornament of the wife; happy are the gazelles who eat the Dúrva, for they see not the face of rich fools. Dúrva is mentioned in the Nighantás; medicinally the fresh juice is considered astringent, and is used as a snuff in epistaxis. The bruised grass is a popular application to bleeding wounds. The Indo-Portuguese call it *gramina*, and use it as a substitute for *Triticum repens*, L., which is generally considered to have been the ἄγρωστις of the Greeks, and Gramen of the Romans, though some authorities are of opinion that both *T. repens* and *Cynodon dactylon* were used indiscriminately by the ancients.

Description.—The roots are tough and creeping, almost woody, with smooth fibres. Stems also creeping to a great extent, matted, round, jointed, leafy, very smooth. Leaves tapering, sharp-pointed, ribbed, hairy, a little glaucous; with long striated smooth sheaths, and a hairy stipula. Flowering branches a span high, leafy, simple, terminating in 4 or 5 nearly equal, crowded, erect, many-flowered linear spikes; the common stalk of each triangular, roughish; flat and slightly bordered on one side, along which the nearly sessile, shining, purplish flowers are ranged in two close alternate rows. The corolla is longer than the calyx, very much compressed, opposite with respect to the latter.

ZEA MAYS, *Linn.*

Fig.—*Lam., Ill., t.* 749; *Bentl. and Trim., t.* 296. Maize, Indian Corn (*Eng.*), Maïs, Blé turc (*Fr.*).

Hab.—S. America and West Indian Islands. The stigmas and meal.

Vernacular.—Makkái, Bhuta (*Hind., Guz.*), Janar (*Beng.*), Makkái, Boṇḍa (*Mar.*), Makka-sholom (*Tam.*).

History, Uses, &c.—A wild form of this cereal is said to be still found in some of the West Indian Islands. The vernacular names point to its introduction into India from Mecca, but the Durah-i-Makka or Gandum-i-Makka of Mahometan writers on Materia Medica, which they also call Khanderús (χόνδρος), is the *Sorghum vulgare* or Great millet, the *Juar* of Northern India, and the *Sholam* of Madras. The Arabs call *Zea Mays* Durah kízán or Durah shámí. We learn from Chinese literature that it was cultivated in China in the 16th century, and was then traditionally asserted to have been an introduction from the west. On the Continent of Europe, it is best known as Turkish corn. It is now cultivated in all warm countries, and is considered by Mahometan physicians to have properties similar to those of *Sorghum vulgare, viz.*, resolvent, astringent, and very nourishing; they consider it to be a suitable diet in consumption and a relaxed condition of the bowels. In Europe it is much used as a valuable article of diet for invalids and children under the names of *Polenta* (Maize meal) and *Maizena* (Maize flour). In Greece the silky stigmata are used in decoction in diseases of the bladder, and have lately attracted attention in America under the name of *Corn silk*, of which a liquid extract is sold in the shops as a remedy in irritable conditions of the bladder with turbid and irritating urine; it has a marked diuretic action. The meal has been long in use in America as a poultice, and gruel is also made of it. In the Concan an alkaline solution is prepared from the burnt cobs and is given in lithiasis.

In the United States for starch manufacture from maize it has been found desirable to get rid of the oily embryo—this is done by machinery. The embryo is too rich for feeding stock unless the oil is removed—this is done in the hydraulic press, and the cake when ground into meal is very valuable as a food for stock. The oil promises to be useful for medicinal purposes instead of olive oil. In the unrefined state it has a specific gravity of ·916 at 15°C., the elaidin test shows the presence of a large quantity of olein. Maize oil is of a pale yellowish-brown colour, with an odour and taste like that of freshly ground corn meal; it belongs to the non-drying group of the vegatable oils, does not easily become rancid, and has no purgative action. With alkalies it forms a white soap; it contains fatty acids (free) 0·88, total fatty acids 96·75 per cent., mucilaginous bodies 1·34. The loss sustained by purification is under 5 per cent. (*J. U. Lloyd, Amer. Journ. Pharm.,* July 1888.)

Chemical composition.—The average results of the analysis of three varieties of maize in an undried state by Polson, yielded in 100 parts, 54·37 starch, 8·83 nitrogenous substance, 4·50 fat, 2·70 gum and sugar, 15·77 cellulose, 12·16 water, and 1·67 ash. Poggiale found on an average in 160 parts of the dried grain, 64·5 starch, 6·7 fat, and 9·9 nitrogenous substance. Church found it to contain water 12·5, albuminoids 9·5, starch 70·7, oil 3·6, fibre 2·0, ash 1·7. American grain contained 1 per cent. more fat than Indian.

The following figures, quoted by König, represent the mean composition of 145 samples examined by various analysts:—

	Minimum.	Maximum.	Mean.
Water	7·40	22·40	13·12
Albuminoids	5·54	13·90	9·85
Fat	1·61	8·89	4·62
Nitrogen-free extractive	60·49	74·92	68·41
Cellulose	·76	8·52	2·49
Ash	·61	3·93	1·51

The stigmata have been examined by C. J. Rademaker and J. L. Fischer (*Amer. Journ. Pharm.*, 1886), with the following results :—

Fixed oil (petroleum spirit extract) …………	5·25
Resin, crystalline principle, and chlorophyll (ether extract) …………	2·25
Resin, crystalline principle, and chlorophyll (alcoholic extract) …………	3·25
Sugar, gum, and extractive (water extract) …	19·50
Albuminoids, phlobaphene, &c. (from alkaline solution) …………	3·50
Salts and extractive (from acid solution) ……	5·50
Cellulose …………	37·00
Water …………	20·00
	96·25

LOLIUM TEMULENTUM, *Linn.*

Fig.—*Engl. Bot. xvi., t.* 1124; *Schreb. Gram. ii., t.* 36; *Bentl. and Trim.* 295. Bearded Darnel (*Eng.*), Ivraie (*Fr.*).

Hab.—A weed of cultivation. Asia, Europe, North Africa. The seeds.

Vernacular.—Múchhni (*Hind.*).

History, Uses, &c.—A noxious weed growing with wheat called ἀίρα is mentioned by Theophrastus (i., 5), and by Dioscorides (ii., 91); the latter writer notices its medicinal use as an external application along with salt and radishes to ulcers, and with sulphur and vinegar to certain skin eruptions, also with pigeon's dung and linseed to disperse or mature glandular and gouty swellings. It was also used with bitumen, myrrh, saffron or frankincense as a fumigatory to promote conception. This plant was known to the Romans as Lolium, and is mentioned by Virgil (Georg. I) as "*infelix lolium.*" Ovid (Fast, i.) speaks of it as injurious to the eyesight, "et careant loliis oculos vitiantibus agri." Pliny mentions it in his chapter upon the diseases of grain (18, 44), and again (22, 58, 77) reproduces the account given by Dioscorides of its medicinal uses. The Arabian lexicographers describe the same plant under the name of Zúwán or Ziwán (زوان) as a noxious weed growing among wheat, which often gives a bad quality to it when accidentally mixed with it, causing giddiness; they consider it to be the same as the plant called Shailam (شيلم). Abu Hanifeh says, that Shailam is a small, oblong, red, erect grain, resembling in form the سوس (or grub) of wheat; and it does not intoxicate, but renders the wheat very bitter; and in one place he says the plant spreads on the ground, and its leaves are like those of the willow.

Ibn Sina describes Zúwán and Shailam separately, but in his account of their properties there is hardly any difference, it being essentially the same as Dioscorides' description of Aira. He states, however, that both are narcotic.

Forskal considers Zúwán and Shailam to be different. Of the former he says:—"Zizania Allepensibus notissima: inter triticum viget: si semina restant farinæ (sic) mixta, hominem reddunt ex panis esu temulentum: messores plantam non separant; sed post triturationem vanni aut cribri ope semina rejiciunt." Of the latter he says:—"Shalim etiam agri vitium; a priore (ziwan) tamen diversa species; decocto plantæ obtunduntur sensus hominis qui operationem chirurgicam subire debet; Avicenna sic referente." (*Fl. Ægypt Arab.*, p. 199.)

Indian Mahometan writers merely copy the Arabians, and we have met with no mention of Darnel by Hindu physicians. In Persia the plant is known as Samuk and Gandum-i-diwáheh "fools' wheat." In Northern India it is called Múchhni "bearded"; it does not appear to be known in the Peninsula or Bengal.

Description.—Annual. Roots a few downy fibres. Stems annual, erect, 3 feet or more in height, stiff, smooth, often branched from the lower nodes. Leaves large, distant; sheaths smooth, striate, ligule short, truncate, blade 5 to 10 inches long, spreading and drooping, ¼ to ½ inch wide, linear, gradually tapering to the acute apex, dark green. Spikelets large, ½ to 1 inch long, 5 to 11 flowered, sessile, laterally compressed, blunt, arranged singly edgewise alternately on opposite sides of the elongated rachis, forming a narrow distichous spike, 6 to 12 inches long; rachis somewhat flexuose, hollowed on alternate sides to receive the spikelets, faintly rough; glumes 2 in the terminal spikelet, nearly equal, only one in the remainder, placed on the outer side of the spikelet, closely appressed, and equalling or exceeding it in length, rather leaf-like, 5-ribbed, convex, smooth, green, subacute, not awned; pales 2, nearly equal in length, the lower rounded on the back, the edges somewhat involute, 5-ribbed, the two outside ribs very strong, obtuse, and membranous at the apex, a little below which arises usually a straight white awn of variable length, the upper pale flat, appressed to the dorsal one, with its margins folded over on the inside, scarious, with two green veins, faintly ciliate on the edges. Lodicules 2, connected at the base, entire. Stamens 3, ovary rounded. Stigmas 2, aspergilliform. Fruit enclosed in the pales (the lower one turgid and thickened), oblong-ovoid, nearly ¼ inch long, blunt, concave on inner surface, pale brown.

Chemical composition.—Filhol and Baillet found the seeds to contain 50 per cent. of starch, albuminoids, and the other constituents found in cereal grains; also a thick, almost concrete green oil, one portion of which was saponifiable, and the other not. It was insoluble in water, but freely soluble in alcohol and ether. The seeds besides contained an extractive substance soluble in water and alcohol. The non-saponifiable portion of the oil they describe as producing tremulousness when swallowed, but without any narcotism; and the extractive as narcotic. Both substances proved fatal to animals.

Ludwig and Stahl, besides starch, gluten, &c., found two acrid oils soluble in alcohol, but insoluble in water; and an acrid bitter glucoside, soluble in water; they attribute the activity of the seeds to the combined influence of these different principles.

The still more recent experiments of Wittstein have convinced him "that the poisonous characters of the seeds are not due to an acid body, nor to a base, but to an indifferent body which is incapable of forming compounds with lead or zinc, and may be completely extracted from the seeds by water or alcohol, and only incompletely by ether."

Dr. P. Antze, who has recently examined the constituents of the plant, both chemically and physiologically, reports (*Arch. f. exp. Path. und Pharm.*, Nov. 1890, p. 126) the isolation of a volatile alkaloid, *loliine*, and *temulentic acid*, which by the action of lime yields a base, *temulentine*, as a decomposition product. Loliine is said to yield good crystalline salts with sulphuric, hydrochloric, oxalic, and acetic acids, but too small a quantity was obtained for analysis. Injected subcutaneously into rabbits it produced a rise in temperature as well as an increase of the pulse, 0·08 gram being a lethal dose, whilst the narcotic and intoxicating action of the lolium plant seems to be due to temulentic acid and the base obtained from it. The acid, which exists to the extent of about 1 per cent. in the seeds, is obtained in crystals melting at 234°C. and possessing the approximate composition $C^{12}H^{19}NO^{19}$, and as well as temulentine yields good crystalline salts. From experiments upon frogs, rabbits, and the investigator himself, it appears to be twice as toxic as loliine and rapidly diminishes the heart's action, but if the depression, which is accompanied by a marked decrease in temperature, is overcome, the patient assumes a condition of high fever. Dr. Antze recommends, in cases of poisoning with darnel grass, the administration of emetics and purges, followed by stimulants to raise the depressed action of the heart. (*Pharm. Journ.*, Jan. 31st, 1891.)

Toxicology.—The symptoms which darnel seeds produce on man are described by Pereira as twofold: "those indicating gastro-intestinal irritation, such as vomiting and colic; and those which arise from disorder of the cerebro-spinal system, such as headache, giddiness, languor, ringing in the ears, confusion of sight, dilated pupil, delirium, heaviness, somnolency, trembling, convulsions, and paralysis. These seeds, therefore, appear to be acro-narcotic poisons. According to Seeger, one of the most certain signs of poisoning by them is trembling of the whole body." Death has sometimes resulted from their use, but when suitable remedies have been used, such as evacuants and stimulants, the seeds have not proved fatal to man. Recent experiments made by A. S. Wilson of Aberdeen conclusively proved that healthy darnel seeds have no injurious effects. In selecting healthy seeds, Mr. Wilson observed the grains to be frequently affected by ergot and other fungi, and to be also liable to a disease of a more obscure type.

From Dr. P. Antze's experiments it appears that there are two poisonous principles in the diseased seeds, one an acrid poison giving rise to a febrile condition, and the other a narcotic powerfully depressing the heart's action.

In the Report of the Chemical Examiner, N.-W. Provinces and Oudh, for 1879, the occurrence of darnel-poisoning among the men of the Ghoorkha Regiment at Almora, and also among some of his own servants at Nynee Tal, is recorded. He states that the grass is recognised as injurious by the peasantry in the Moozaffarnagar District, where it is called *Mochni*. The symptoms observed were vomiting, headache, and great giddiness ; no fatal cases occurred.

BAMBUSA ARUNDINACEA, *Retz.*

Fig.—*Roxb. Cor. Pl. i., t.* 79 ; *Rheede, Hort. Mal. i., t.* 16. Bamboo (*Eng.*), Bambou (*Fr.*).

Hab.—Throughout India. The young shoots, seeds, and silicious concretion.

Vernacular.—Báns (*Hind.*, *Beng.*), Vánsa (*Guz.*), Vánsa, Kalaka, Tokara (*Mar.*), Mangal (*Tam.*), Bonga, Veduru (*Tel.*), Bidungulu (*Can.*).

Bamboo Manna.—Báns-lochan (*Hind.*), Báns-kápúr (*Beng.*), Vánsa-lochana (*Mar.*), Vánsa-kápúra (*Guz.*), Munga-luppa (*Tam.*), Veduruppu (*Tel.*), Bidaruppu (*Can.*), Moleuppa (*Mal.*).

History, Uses, &c.—The Bamboo, in Sanskrit Vanśá and Vénu, is considered by the Hindus to have the hardest of woods. The word also signifies 'spine' and 'lineage,' thus Vánsa-visuddha means "made of a good bamboo," *i.e.*, of a pure or good family, and Vanśa-dhara "carrying a bamboo," *i.e.*, maintaining a family, Vansa-pratishthana-kara "establishing a family on a sure foundation." The Abbé Dubois, in his *Description of India*, states that the young Indian bride and bridegroom are made to stand in two bamboo baskets placed side by side, and the *Kul* or *Arbor generationis* of the caste, at Hindu marriages, is placed in a winnowing fan made of bamboo. The wild tribes of the Garrow hills, who have no temples or altars, set up opposite their huts a bamboo post which they deck with flowers and tufts of cotton, and before it they make offerings to their god. Indian anchorites carry a bamboo stick having seven knots. A bamboo flowering is an event of rare occurrence, and which is supposed to bring in its train all sorts of evil, accompanied by dire distress and famine. The seeds of the bamboo, in Sanskrit Vanśa-tandula, Vanśa-ja, Vénu-yava, Vénu-vija, have often proved of great value in famine seasons, saving thousands of lives; this was the case in Orissa in 1812 and in Canara in 1864. The young shoots which appear towards the end of the rainy season are used as a vegetable; they are minced very finely and soaked in water to remove the bitter taste, and then cooked with *dál*, and seasoned according to taste: they are also made into pickle.

A decoction of the joints of the bamboo is supposed to have an action on the uterus, and is used by females after delivery to cause a free flow of the lochial discharge. The same part of the plant pounded with water is applied to inflamed joints. The juice of the leaves with aromatics is given in hæmatemesis. The leaves are very commonly given to horses by syces as a remedy for coughs and colds.

Bamboo manna is the Vanśa-lochana of the Indian physicians; in the Nirghantás it bears many synonyms, such as Vanśa-rochana, Tvak-kshirá "bark-milk," Vanśa-karpura "bamboo camphor," Vanśa-śarkara "bamboo sugar," Vanśáhva "bamboo sacrifice," Súbhra, and Sita "white," &c. It is considered to be strengthening, tonic, cold, and sweet; to alleviate thirst, and to avert phthisis, fever, asthma, cough, biliousness, skin diseases, and Váyu (morbid affections of the windy humor). As an example of the way in which it is prescribed, the following formula for making the *Sitopaládi-churna* will be found in Sarangadhara:—Bamboo manna 8 parts, long pepper 4, cardamoms 2, cinnamon 1, sugar 16. Powder and mix. Dose about 60 grains, to be given with honey and *ghi* in phthisis and cachexia.

The belief in the strengthening properties of bamboo manna appears to have originated among the aboriginal tribes of India, as on the West Coast it is the first solid food which the Thana Kolis give their children. The same belief seems to have prevailed in Borneo, as Marco Polo relates that pieces of this substance were let in under the skin by the natives to make the body wound-proof.

We hold with Salmasins that bamboo manna was the substance known to the Greeks as *σάκχαρ σάκχαρον*, and described by them as a white, concreted or crystalline substance like common salt, because there was no kind of sugar prepared from the sugar-cane, answering to this description, known in India in the time of Dioscorides. The name Śarkara, which signifies "grit, pebbles, sand," was applied by Hindu writers at that time to several substances, *viz.*, *Guda* or molasses in a dry granular state, the only kind of cane-sugar then in use in India; *Yavása-śarkara,* the concrete manna of Alhagi; and *Vanśa śarkara,* the concretion found in the bamboo. The Sanskrit name Khanda was also applied to Guda, which is the substance known in the vernaculars as Gúr or Gúl, and is still the kind of sugar most used by the Hindus. Pale crystalline sugar, the *Chini* of the bazars, does not appear to have been known until some 400 years after the date of Dioscorides.

Under the name of Tabáshir, a corruption of the Sanskrit Tvak-kshira, bamboo manna was known to the early Arab travellers in the East; the port of Thana, on the West Coast of

India, was famous for its Tabáshir in the time of Idrisi (1135) and supplied it to all marts. Ibn Sina describes Tabáshir as astringent and stomachic, useful in erysipelas and to allay thirst in bilious dyspepsia, cardiacal, and strengthening. As a local application it is used to relieve the heat and irritation caused by aphthous eruptions along with pounded rose leaves. Later Mahomedan writers upon the Materia Medica of the East have added nothing of importance to Ibn Sina's account of the drug. Flückiger (*Zur Geschichte des Tabaschir, Zeit. des allg. österr. Apoth. Ver.* Nr. 14 u. 15,1887) mentions a list of Indian goods on which transit duty was levied at Aden in 1270; in it Tabáshir is mentioned together with tamarinds and camphor. He also draws attention to a remarkable connection between Tabáshir and ivory ashes, generally known by the name of *Spodium*. Idrisi, in the middle of the 12th century, points out that the latter was used to adulterate the former, while others of a different opinion assign a greater value to Spodium. Garcia d'Orta (*Colloquios* 51) mentions both Tabáshir and Spodium, which he considers to be Pompholyx or Turtia (white of zinc? calamine?), and states that in Persia and Arabia Tabáshir was generally paid for by its weight in silver ("o preço ordinario na Persia e Arabia é a peso de prata"); he also describes black or grey Tabáshir, which was of less value and was obtained by burning the bamboo cane. Flückiger remarks that it is most likely that the name "Spodium da canna" was given to this black Tabáshir or perhaps to the ashes of the cane, and that it might be owing to this circumstance that in later times the name Spodium came to be applied to animal charcoal (bone-black). The idea of black seems not to have been connected with the original Greek name *σποδος* (ashes). Flückiger also draws attention to the Latin translation of a Persian *Karabádin* or Pharmacopœia by the Carmelite Friar P. Angelus, published in Paris in 1681, in which Tabáshir is spoken of as *pseudo-spodium, anti-spodium*, and *spodium-arabicum*. Rheede as well as Rumphius notice Tabáshir, but it does not appear to have attracted much attention in Europe until Dr. Patrick Russell drew the attention of the Royal Society to it, and induced

James Louis Macie to make an analysis, which showed that it consisted principally of silica.

Further information on Tabáshir may be obtained from Prof. Flückiger's papers above mentioned, and a paper by Dr. Brandis in the *Indian Forester*, March, Vol. XIII.

Description.—Tabáshir consists of irregularly-shaped fragments of an opaque white or bluish opalescent colour, the larger pieces are about an inch in diameter, concavo-convex, and have evidently derived their form from the joint of the bamboo in which the deposit has collected. The raw article is blackened and dirty, having apparently been obtained by burning the bamboos, or on account of the presence of insects; to make it fit for use it is calcined, when it becomes perfectly clean.

Chemical composition.—Cavendish (*Ebenda,* 370) determined the specific gravity of Tabáshir to be 2·169 at 11·4°C.

Humboldt remembered the analysis of Macie when he and Bonpland discovered a similar substance at the volcano of Pichincha, not far from Quito. He wrote from Mexico on the 22nd of April 1803 to Antonio Joseph Cavanilles, Director of the Botanic Garden at Madrid (*Annales du Muséum,* iv. (An. xii., 1804), 478)—"Vous vous souvenez sans doute de cette substance siliceuse, ressemblante à l'opale que M. Macie analysa en Angleterre. Nous l'avons découverte à l'ouest du volcan Pichincha, dans les bambous ou gros roseaux appelés *Guaduas* dans le royaume de Santa Fé. J'ai fait des expériences chimiques sur le sue de cette graminée colossale, avant que la substance siliceuse se fût déposée, et j'y ai remarqué des phénomènes très-curieux; il est susceptible d'une putréfaction animale, et paraît annoncer une certaine combinaison d'une terre simple avec l'azote." The *Guaduas* are the representatives of the Indian bamboos in South America and closely related to them. The specimen of American Tabáshir which Humboldt sent to Paris was examined by Fourcroy and Vanquelin (*Ann. du Mus.*, vi. (1806), 382—385); they found, besides 70 per cent. of silicic acid, 30 per cent. of potash and lime. It would be interesting to know if it was perhaps a silicate, which seems possible, as they mention traces of crystallization. The remarkable optical properties of this amorphous silicic acid attracted the attention of Brewster (*Trans. Roy. Soc. London* (1819), i., 283—299), who found it to possess very little power of refracting light, and to show when heated in the dark a brilliant phosphorescence. The information concerning its physical properties given by Brewster was, however, partly contradicted, and, as it seems, with reason, by Guibourt in 1885. Edward Turner (*Ebenda*, pp. 335—338) found that the substance examined by Brewster could easily be dissolved in a solution of caustic potash, even after having been heated; the silicic acid separated from the solution, after being heated to redness, weighed nearly as much as the quantity of Tabáshir examined. The transparency which Tabáshir acquires when immersed in water was noticed by Brewster and Guibourt; this property is still more striking when it is immersed in a volatile oil or liquid paraffin, for then with very pure specimens the outlines are scarcely to be distinguished. Guibourt determined its sp. gr. in water to be 2·149 at 4°C., and found Indian Tabáshir to be composed of 97·39 per cent. of silicic acid, 2·9 per cent. water, with traces of potash and lime.

In 1859 Flückiger (*Schweizerische Zeitsch. f. Pharm.*, 1859, 244) examined a very fine specimen of Tabáshir from Java, where it is known by the name of *Batugining*, and found it to be almost pure silicic acid. It would appear, however, to be sometimes mixed or adulterated with the ashes of the cane, as Rost van Tonningen (*Jahresb. der Chem.*, 1860, 531) found a specimen to contain silicic acid 86·38, water 7·63, oxide of iron, potash, and lime 5·99 per cent.

The careful examination of Tabáshir made by Poleck (*Zeitsch. des österr. Apoth. Ver.*, 1887, p. 139) shows beyond doubt that it may be considered to be silicic acid, although the question remains open, whether it is the normal acid $\mathrm{Si(OH^4)}$. (Flückiger, *Zur Geschichte des Tabaschir*, *Zeitsch. des allg. österr. Apoth. Ver.* Nr. 14 u. 15, 1887.) As regards the variations observed in the amount of water contained in this substance, the reader is referred to our remarks under *Commerce*.

The ash of bamboo stems has been analysed by Hammerbacher with the following results: SiO^2, 28·264; CaO, 4·481; MgO, 6·569; K^2O, 34·217; Na^2O, 12·765; Cl, 2·062; SO^3, 10·705; Ferric phosphate, 0·037=99·100. The ash is rich in silica and alkalis, poor in alkaline earths. The proportion of alkalis is about the same as in the ashes of ordinary roots. (*Liebig's Annalen*, clxxvi., 87.)

Commerce.—Bombay appears to have inherited the ancient trade in Tábáshir which formerly centered in Thana. The raw article is, however, now obtained from Singapore, and is probably the produce of Java and other islands of the Eastern Archipelago. The Indian bamboos being under the protection of the Forest Department prevents their being destroyed to obtain Tabáshir, besides they are of much more value for other purposes. The Bombay trade in this article is now the monopoly of a Mahometan, who is the sole importer of the raw material, which he calcines and afterwards sells in bulk at Rs. 2-10 per lb. He also sells a selected quality at Rs. 4 per lb., and an inferior quality at Re. 1-4. The method of calcination is a trade secret. After it has been calcined, Tabáshir is placed in water, which it absorbs and increases greatly in weight, becoming cold to the touch; this fact is pointed out to the purchaser as a proof of its cooling qualities. The water is retained by the drug for a long time.

SACCHARUM OFFICINARUM, *Linn.*

Fig.—*Woodville, t.* 266; *Tussac, Fl. Antilles, i., tt.* 23—25; *Bentl. and Trim., t.* 298. Sugar-cane (*Eng.*), Canne à sucre (*Fr.*).

Hab.—India. Cultivated in all warm climates. The juice and root.

Vernacular.—Úkh, Ganna (*Hind.*), Ák (*Beng.*), Ús (*Mar.*), Shéradi (*Guj.*), Karumbu (*Tam.*), Cheruku (*Tel.*), Karimpa (*Mal.*), Khabbu (*Can.*).

History, Uses, &c.—If the wild form of the sugar-cane is to be anywhere now met with, it is in India, of which country it is undoubtedly a native, and where it has been cultivated from the earliest antiquity. Whether the species grown in China, *S. sinense* (Roxb.), is specifically the same is scarcely determined with certainty, but it is probably native in that country. (*Bentl. and Trim.*) The Sanskrit name of the plant is Ikshu, and it is also called Guda-trina, "the grass from which *guda* is made," and Guda-dáru, &c.; from the juice (Ikshurasa) the ancient Hindus prepared an extract by boiling, which, when soft and sticky, was called Ikshurasa-kvátha, Phánita, and Guda, but when allowed to drain and become dry was known as Guda-śarkará, Khanda or Khanda-sarkára, and Matoyandika. Twelve varieties of sugar-cane are mentioned by Sanskrit writers, but in this number are probably included other grasses belonging to the genera *Saccharum*, *Sorghum*, &c. The root of the sugar-cane is also used in Hindu medicine, and is considered to have demulcent and diuretic properties. It is an ingredient along with the roots of *Saccharum sara*, *S. spontaneum*, *Eragrostis cynosuroides*, and *Cynodon dactylon* in the compounds known as *Trinapancha-mula* and *Kuśa-valeha*, which are much prescribed as adjuncts to metallic medicines in gonorrhœa and other affections of the urinary passages. A kind of rum was also obtained by the ancient Hindus from the juice of the cane or from *guda* and water fermented, which was known as Sidhu and Ganda.

The unrefined, dark-brown Guda or Phánita of the Hindus was known to the ancient Persians as پانیذ (Pániz) and شکر (Shakar); from it they manufactured the dry crystalline sugar which they call کند (Kand) or نبات (Nabát), now generally written قند by both Arabs and Persians. We have already stated (see Article on Bambusa) our reasons for believing that the σάκχαρον of Dioscorides was not cane-sugar, *viz.*, that no such article as sugar in a dry crystalline state was known in India at that time, the only kind of sugar used by the Hindus being the dark-brown mass known as *guda*, and which is still the kind of sugar most popular in India. This substance, as well as the *guda* prepared from the palm (φοίνιξ), was called by the Greeks μελι (honey), and is mentioned by Herodotus, Theophrastus, Seneca, Strabo, and other early writers as "Honey of Canes" and "Honey made by human hands." The vernacular names Misri, "Egyptian," for refined sugar, and Chini, "Chinese," for sugar-candy, point to these crystalline forms of sugar as comparatively recent introductions into India, and at the present time the sugar-candy of Indian commerce is chiefly imported from China. When we consider that the sugar-cane was known to the ancients from the time of Nearchus, it is hardly reasonable to suppose that Pliny could be so ill-informed as to speak of Saccharum, if by that name he meant cane-sugar, as only employed in medicine. Lucan, writing about the same time, was aware that the Hindus drank the juice of the cane:

> "Quique bibunt tenera dulces ab arundine succos."

At the present day, the cane-presser, with his primitive press, is a familiar personage at Indian fairs, where he dispenses the luscious juice to his customers at about twopence a pint.

Sugar, under the name of Shi-mi "stone honey," is frequently mentioned in the ancient Chinese annals among the productions of India and Persia; and it is recorded that the Emperor Tai-tsung (A.D. 626—650) sent an envoy to the kingdom of Magadha in India, to learn the method of manufacturing it. (*Bretschneider*, *Chinese Botanical Works*, 1870, 46.) The Chinese acknowledge that the Indians between A.D. 766 and 780 were their first teachers in the art of making sugar. An Arabian writer, Abu Zaid-el-Hasan, states that about A.D. 850 the sugar-cane was growing on the north-eastern shore of the Persian Gulf; and in the following century, the traveller Ali Istakhri found sugar abundantly produced in the Persian Province of Kuzistan. About the same time (950) Moses Chorenensis stated that the manufacture of sugar was flourishing near the celebrated school of medicine at Jondisabur in the same province, and remains of this industry in the shape of millstones, &c., still exist near Ahwas.

Persian and Arabian physicians of the 10th and 11th centuries, such as Rázi, Ali Abbás, and Ibn Sina, introduced sugar (سكر Sukkar) into medicine. The Arabs cultivated the cane in many of their Mediterranean settlements, as Cyprus, Sicily, Italy, Northern Africa, and Spain. The Calendar of Cordova shows that as early as A.D. 961 the cultivation was well understood in Spain, which is now the only country in Europe where sugar-mills still exist.

The importance of the sugar manufacture in the East was witnessed by Marco Polo, Barbosa, and other European travellers; and the trading nations of Europe rapidly spread the cultivation of the cane over all the countries of which the climate was suitable. The ancient cultivation in Egypt, probably never quite extinct, was revised on an extensive scale by the Khedive Ismail Pasha. (*Pharmacographia.*)

Sugar is of comparatively little value for its independent effects, but few substances are more useful as an associate of other medicines, whether to preserve them from oxidation and decomposition, to conceal or improve their taste, or to give them special pharmaceutical forms.

In solution sugar is almost exclusively lenitive, but in powder it is stimulant. It is universally employed to diminish dryness of the mouth and fauces, to allay irritation, and to mitigate cough and hoarseness. Sugar dissolved in water is said to have a diuretic effect. When injected into the veins of animals it is said to be powerfully diuretic (Richet and M. Martin, *Med. Record,* xxi., 394). It certainly, when moderately used, promotes digestion and allays nervous excitement. For these purposes sweetened water (*eau sucrée*) is universally employed in France and Southern Europe. Formerly a strong solution of sugar was much used as an antidote to corrosive poisons. It enters into all the drinks, mucilaginous, farinaceous, and gelatinous, employed in febrile diseases. Finely-powdered sugar will sometimes relieve the hiccough, which, in nursing infants, is apt to arise from over-feeding. Loaf-sugar, eaten freely, is said to arrest the development of alcoholic intoxication, perhaps by retarding gastric absorption. A strong solution of sugar injected into the rectum has been used successfully to destroy ascarides of that part. In powder it is very efficient as a remedy for aphthæ of the mouth, in repressing the exuberant and stimulating the indolent granulations of ulcers, in removing opacities of the cornea, and in curing granular eyelids. Sugar has been claimed by Fischer to be an efficient antiseptic dressing for wounds. He associated it, however, with other antiseptics; but Windelschmidt states that for small wounds sugar is equal to iodoform as a dressing (*Med. News*, xliii., 462). In chronic laryngitis, when inhaled by a sudden aspiration from a tube extending to the root of the tongue, it may be used with advantage alone or mixed with other powders. In the same manner it may be employed as a snuff in chronic ozæna. The fumes from burnt sugar destroy offensive effluvia, and are conveniently disengaged by sprinkling sugar upon burning coals or on a hot shovel. (*Stillé and Maisch.*) We have already referred to the use of sweetmeats by opium-eaters to counteract the effects of the drug (p. 96, Vol. I.).

Cultivation.—The sugar-cane season comprises nearly a twelvemonth. The land chosen is usually a good loam or light clay manured. The leafy ends of the preceding season's canes are cut off, or the whole cane is chopped into pieces so as in any case to include two nodes or joints, and these, to the number of about 20,000 per acre, are planted in furrows in January and February. The land is irrigated occasionally from this time to the commencement of the rains. The harvest begins in the beginning of December, and the cutting and crushing of the canes and boiling of the juice is carried on till January and February. Excepting the few mills under European management, the crushing and boiling is performed by primitive, and, therefore, rude processes. The average outturn per cent. of cane in the North-West Provinces is stated by Messrs. Duthie and Fuller to be as follows: 100 of canes=15 of juice=18 of *guda* (unrefined sugar) or 17·5 of *shakar* * (dry, unrefined sugar), or 19·5 of *ráb* (syrupy sugar). The natives generally manufacture the juice into the two kinds of *guda*, called in the vernaculars *gúra* or *gúla*.

Description.—The transverse section of a sugar-cane exhibits numerous fibro-vascular bundles, scattered through the tissue, as in other monocotyledonous stems; these bundles are most abundant towards the exterior, where they form a dense ring covered with a thin epidermis, which is very hard from the quantity of silica deposited in it. In the centre of the stem the vascular bundles are few in number, and traverse an abundant parenchyma which contains in its thin-walled cells an almost clear solution of sugar, with a few small starch granules and a little soluble albuminous matter. The latter is found in larger quantity in the cambial portion of the vascular bundles. The walls of the medullary cells contain pectic matter, but not in sufficient quantity to cause them to swell much in water. (*Wiesner.*) The unrefined sugar of India (gúra or gula), often incorrectly termed molasses, occurs in two forms in the bazars—one is a blackish sticky mass without evident crystalline structure, the other is a dark-brown partly crystalline mass which crumbles on pressure, and is generally spoken of by the dealers as floury *gúr* or *gúl*—the first contains the whole of the uncrystallizable portion of the syrup, in the other most of this has been drained off. Indian molasses or treacle is of a very dark colour, of a peculiar sharp flavour, and has a bitterish after-taste caused by the presence in it of caramel or burnt sugar, produced during the careless evaporation of the cane juice. It is hardly suited for pharmaceutical purposes, and as sold in the bazars is generally freely watered and in a state of fermentation. The refined sugars of Indian commerce are manufactured on the European system, chiefly in Bengal, or are imported from Mauritius, and, in the case of loaf-sugar, from France. They differ in no respect from the sugars of European commerce.

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* Called by Europeans *Jaggery*, a corruption of the Sanskrit Sarkara, which in Ceylon is the vernacular name for unrefined sugar in the corrupted form of Shakkare.

Chemical composition.—The sugar-cane is, when mature, composed of cellulose 8 to 12 per cent.; sugar 18 to 21; water, including albuminous matter and salts, 67 to 73. Of the entire quantity of juice in the cane, from 70 to 84 per cent. can be extracted by crushing and pressing, and yields in a crystalline state about three-fifths of the sugar which the cane originally contained. The juice has on an average the following composition:—

Albuminous matters	0·03
Granular matter (starch?)	0·10
Mucilage containing nitrogen	0·22
Salts, mostly of organic acids	0·29
Sugar	18·36
Water	81·00
	100·00

There is also present in the juice a very small amount of a slightly aromatic substance (essential oil?) to which the crude cane-sugar owes a peculiar odour which is not observed in sugar from other sources. (*Pharmacographia.*) Sugar, $C^{12}H^{22}O^{11}$, may be obtained in large transparent rhombic prisms, known as *sugar-candy*, which does not differ from lump-sugar, except that the latter is in crystalline masses from disturbed crystallization. Sugar has the specific gravity 1·58 (*Kopp*), is permanent in the air, neutral, without odour, has a very sweet taste, and dissolves at ordinary temperatures in one-half its weight of water, yielding a dense, sweet, and colourless liquid known as syrup; saturated at 15° C. such a solution contains 66 per cent. of sugar, and this has the density 1·345082 (*Michel and Kraft*). At the boiling-point sugar dissolves in water almost in all proportions. It requires for solution about 80 parts of boiling absolute alcohol, 28 parts of boiling officinal alcohol, and about 4 parts of boiling alcohol, spec. grav. ·830, these solutions depositing most of the sugar on cooling. The solubility is greater in weak alcohol, both cold and hot. At 15° C. 1 part of sugar dissolves in 2 parts of 50 per cent. alcohol, in 7·7 parts of 75 per cent. alcohol, in 14·7 parts of 80 per cent. alcohol, in 31·6 parts of 85 per cent. alcohol, in 175 parts of 92 per cent. alcohol, and in 228 parts of methylic alcohol of the same strength (*Casamajor*). Sugar dissolves also in glycerin, the solubility being increased on dilution with water, but it is insoluble in ether, chloroform, carbon disulphide, and in hydrocarbons. It combines with chloride of sodium, yielding deliquescent crystals which contain 14·9 per cent. of that salt. Definite compounds have likewise been obtained with several other salts and with alkalies and alkaline earths. When triturated in the dark it becomes luminous. Its solution deviates polarized light to the right—a behaviour which is of great practical importance for the estimation of sugar in aqueous liquids and for distinguishing different kinds of sugar which have a different rotary power.

When sugar is heated to 160° C. it melts without losing in weight, and congeals on cooling to a transparent amorphous yellowish mass known as *barley-sugar, saccharum hordeatum*, which becomes gradually opaque on the surface from the formation of minute crystals. If sugar is kept in the melted state between 160° and 170° C. for a short time, it is converted into a deliquescent mixture of *glucose* and *levulosan*; $C^{12}H^{22}O^{11}$ yields $C^{6}H^{12}O^{6} + C^{6}H^{10}O^{5}$; the latter is not fermentable until after it has been boiled with water or dilute acids. When heated to between 180° and 200° C. sugar turns brown, evolves a peculiar odour, and is converted into *caramel*, $C^{12}H^{18}O^{9}$, parting at the same time with $2H^{2}O$; the pure product of this composition, *caramelan*, was obtained colourless by Gélis (1862). Caramel may be prepared in the same manner from inferior qualities of sugar, from molasses, and from glucose, and the conversion is hastened in the presence of small quantities of alkalies; the addition of a little carbonate of ammonium, which is again volatilized by the heat, is of service, for the reason stated. Subjected to dry distillation, sugar yields aldehyd, acetone, acetic acid, tarry products, and carbonic acid, carbonic oxide, and marsh gas. According to Lassaigne, iodine heated with solution of sugar is converted into hydriodic acid. Under the influence of ferments, as well as of dilute acids, cane-sugar is converted into *invert-sugar,* which is a mixture of *dextrose* or grape-sugar and *levulose* or fruit-sugar, and is directly fermentable. This inversion of sugar takes place slowly on boiling with water, but cold aqueous solutions keep unaltered for a long time, provided the access of ferments suspended in the air be prevented. Under the same condition, according to the investigations of Kreusler, Lemoine, and others, light does not exert the inverting effect reported by Raoul (1871). Nitric acid inverts cane-sugar, readily, and when heated with it produces saccharic, racemic, tartaric, and oxalic acids.

Tests.—The purity of cane-sugar is ascertained by the physical properties described above and by its complete solubility in water and alcohol. The absence of glucose or of a similar sugar is ascertained by some of the reactions given below. "Aqueous and alcoholic solutions of sugar should have no effect on litmus-paper. The solution in 20 parts of distilled water should be scarcely rendered turbid by silver nitrate or barium nitrate (chloride and sulphate)." Neither an aqueous nor an alcoholic solution of sugar kept in large, well-closed, and completely-filled bottles should deposit a sediment on prolonged standing (absence of insoluble salts, foreign matters, ultramarine, Prussian blue, &c.). If a portion of about 1 Gm. of sugar be dissolved in 10 cm. of boiling water, then mixed with 4 or 5 drops of test solution of nitrate of silver and about 2 cm. of water of ammonia, and quickly heated until the liquid begins to boil, not more than a slight coloration, but no black precipitate should appear in the liquid after standing at rest for 5 minutes (absence of grape-sugar and of more than a slight amount of inverted sugar). (*Stillé and Maisch.*)

Commerce.—The following statistics of the trade in Sugar are taken from the Reports on the inland trade of the different provinces and on the trade by sea:—

Articles.	Value in lakhs of Rupees.				Quantity in thousands of cwts.				
	1888-89.	1887-88.	1886-87.	1885-86.	1888-89.	1887-88.	1886-87.	1885-86.	Weight.
Sugar, refined...	10	4	4	3	144	38	33	25	cwts.
Do. unrefined.	45	42	46	50	869	1,009	953	1,143	,,
Total ...	55	46	50	53	1,013	1,047	986	1,168	cwts.
Sugar, refined...	...	18	20	21	...	150	158	163	cwts.

ORYZA SATIVA, *Linn.*

Fig.—*Bentl. and Trim., t.* 291; *Rheede, Hort. Mal. v.*, 196—201. Rice (*Eng.*), Riz (*Fr.*).

Hab.—Throughout India, wild and cultivated. The grain, spirit, and vinegar.

Vernacular.—Dhán (*Hind., Beng.*), Bhát (*Mar.*), Chokha (*Guz.*), Arishi (*Tam.*), Biyyam (*Tel.*), Akki (*Can.*).

Husked Rice.—Chával (*Hind., Beng.*), Tándula (*Mar.*).

History, Uses, &c.—Wild rice was probably used by the aboriginal tribes of India in prehistoric times; it is still carefully collected by the peasantry, who consider it to have special virtues, and call it "god's rice," "hermit's rice," &c. Rice (व्रीहि vríhe) is not mentioned in the *Rig-Veda*, but in the *Atharva-Veda* it is noticed along with barley, másha (*Phaseolus Roxburghii*), and sesamum. Rice cultivation in India appears to have been subsequent to that of China and Burma. Girard de Rialle, in his *Mythologie comparée*, states that the Karens of Burma believe that every plant has its *là* or *kelah* (spirit). The rice has its spirit, and when the crop is bad, they pray to it in the following terms: "Come, O spirit of the rice, come back! come to the rice-field, come to the rice! come from the East, come from the West, come from the beak of the bird, from the mouth of the monkey, from the throat of the elephant, come from the grain stores! O *kelah* of the rice, return to the rice!" In Siam they offer rice and cakes to trees before cutting them down. In Bengal sacrifices of rice are made to the Bael tree, probably a survival of an ancient fetish worship which the Brahmins have sanctioned by deifying the tree.

Rice plays an important part in the marriage ceremonies of the Hindus. According to the Grihya-sutra of Asvalayana, the bride must walk three times round the altar, and at the completion of each turn make an offering of rice. This ceremony resembles an ancient form of marrying among the Romans, in which an offering of a cake made of *fár* (spelt)* was made in the presence of the Pontifex Maximus or Flamen Dialis and ten witnesses.

Parched rice, *Lájá*, also called *Syálá* (*Sya* "a winnowing fan," and *lá* for *lájá*), is scattered by the bride's brother at marriages. Rice is poured over the head of the bride and bridegroom as an emblem of life, regeneration and plenty. On the fourth day of the marriage ceremonies the young couple eat rice together for the first and only time in their lives, and on the last day they both celebrate together the Soma sacrifice, when they throw *lájá* into the fire. At the birth of a child the father places the red Akshata rice on its forehead to avert evil, and when the child is named it is placed on a cloth covered with rice. Rice is also used in some parts of India to detect witches: a small bag of rice, bearing the name of each of the suspected parties, is placed in a white-ants' nest, and the one they first eat is considered to belong to the guilty party. When several persons are suspected of a crime, rice is sometimes used to detect the guilty one— For this purpose the persons are required to chew rice, the criminal being discovered by his inability to properly masticate it, owing probably to fear checking the free flow of saliva. Vincenzo Maria da Santa Caterina mentions in his travels that rice and turmeric are offered in India to the gods to obtain children and the cure of female diseases, and that young girls make a vow to offer rice, should they obtain a good husband. In the consecration of the Brahmachari, the father of the youth carries in his hands a cupful of rice, and the assistants after the bath cover the candidate with rice. Asvalayana says that the disciple asks alms to learn the Vedás; he obtains the rice as alms and must cook it before sunset. His commentator, Narayana, adds that when the rice has been cooked, the disciple should say to his master, "the food of the pot is ready." In sacrifices to Rudra, according to Asvalayana, the husk of rice was thrown into the fire along with the smallest grains, and the tail, skin, head, and feet of the animal, and that the latter before being killed was sprinkled with rice and barley-water.

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* *Triticum Spelta*, Linn., or German wheat.

In times of fasting and penitence, grains of rice and barley are watered and blessed and offered to the gods. In funeral ceremonies rice and other food is offered to crows. According to Manu, the twice-born are directed to offer five great sacrifices, *viz.*, with wild rice (Nivára), with various pure substances, or with herbs, roots, and fruits.

The practice of worshipping the new rice at the time of the harvest is common throughout India. In Bengal, on a Thursday, in the month of Pansha (December-January), after the crop has been reaped, a rattan-made grain measure called *rek*, filled with the grain upon which are placed gold, silver and copper coins and some cowrie shells, is worshipped as the representative of the goddess of fortune. This worship is repeated in the months of Chaitra, Sravana, and Kártika. In Western India the new rice is worshipped at the Dasara and Devali festivals, and in Madras the same event is celebrated by the *Pongol* ceremony, when the new rice is boiled for the first time and eaten with great rejoicings. Among the Native Catholics the same ceremony is perpetuated in the "blessing of the new rice," which is done by the priest in the field before the crop is cut.

That the cultivation of rice had widely spread in the time of Alexander (400 B.C.) we learn from Strabo, who says, "according to Aristobulus, rice grows in Bactriana, Babylonia, Susida," and he adds, "we may also say in Lower Syria." Further on he notes that the Indians use it for food, and extract a spirit from it. The Greek names for rice are derived from the Sanskrit *Vrihi;* the earliest form occurs in a fragment of Sophocles, where rice-bread is called ὀρίνδης ἄρτος; in later writers we meet with the form ὄρυζα. The Arabic names have the same derivation, the oldest form being Runz, occurring in the local dialect of the Abd-el-Kais, near Bahrain, and the more modern forms Aruzz and Ruzz. In Persian the form of Birinj is current, as well as the Sanskrit name Shâli, for unhusked rice. Dioscorides briefly mentions rice as being of little nutritive value and apt to cause costiveness. Celsus (ii., 20) classes it along with wheat and spelt as "res boni succi." According to Sanskrit writers, the best class of grains includes wheat, rice, and barley only, other kinds being relegated to the class *Kshudra dhánya* or inferior grains. The preparations of rice used in the diet of sick people, and described in Sanskrit medical works, are:—

यवागु (yavágu) or powdered rice boiled with water. It is made of three strengths, namely, with nine, eleven, and nineteen parts of water, called, respectively, *Vilepi, Peyá,* and *Manda.* Instead of water, a light decoction of some aromatic and carminative drug, such as ginger or pepper, may be used in preparing *yavágu.*

लाजा (lájá) or unhusked rice parched in hot sand. It is used as light and digestible diet for the sick.

भृष्टतण्डुल (brishta tandula) or husked rice parched in hot sand. It is used for the same purposes as *lájá.*

पृथुका (prithuká) or unhusked rice moistened, parched, and afterwards flattened and the husk removed. It is soaked in water or boiled and given with curdled milk as an astringent diet in diarrhœa or dysentery.

पायस (páyasa) or rice-milk. A well-known preparation.

तण्डुलाम्बु (tandulámbu) or water in which unboiled rice has been steeped. This is often used as a vehicle for powders, &c., and as a diet drink.

Rice is the staple-food of the inhabitants in Bengal, many parts of Madras, Burma, and the Western Coast of India, but not of the central and northern parts of the country, where wheat and millet are the staples and rice only a luxury.

Fermented and distilled rice liquors are largely used in many parts of India. For an account of the economic uses of the grain, its cultivation, and the numerous varieties of the plant met with in different parts of the country, we must refer the reader to a diffuse but interesting article by Dr. G. Watt in the *Dictionary of the Econ. Prod. of India.*

Chemical composition.—Rice has been examined by Letheby, Payen, and others. Payen gives the percentage composition of dried rice, as, nitrogenous matter 7·55, carbohydrates 90·75, fat 0·8, and mineral matter 0·9. In chemical composition rice closely resembles the potato; one hundred parts of dried potato, according to Letheby's analysis, contain, nitrogenous matter 8·4, carbohydrates 88, fat 0·8, and saline matters 2·8 parts per cent.

Church (*Food Grains of India*) gives the following percentage composition of cleaned rice:—Water 12·8, albuminoids 7·3, starch 78·3, oil 0·6, fibre 0·4, ash 0·6. Professor Church remarks, 100 parts of rice contain no more than ·065 of potash and ·284 of phosphoric acid. König quotes 20 analyses of rice by various chemists, the mean percentage composition being, water 13·11, albuminoids 7·85, fat ·88, nitrogen-free extract and starch 76·52, cellulose ·63, ash 1·01. Where rice constitutes almost the entire food of the population, the throwing away the water in which it has been boiled involves the loss of some of the mineral matter, and is to be deprecated; no more water should be used in cooking this grain than can be absorbed by it. Two pounds of cleaned rice weigh 5 pounds after boiling.

Commerce.—The following table shows the exports of Rice (husked) from India during the last ten years in thousands of cwts :—

Year.	Burma.	Bengal.	Madras.	Bombay.	Sind.	Total.	Value in lakhs of Rupees.
1880-81......	16,730	6,717	2,363	927	32	26,769	89,717
1881-82......	16,690	7,617	1,549	614	49	28,519	82,496
1882-83......	21,249	7,838	1,319	552	71	31,029	84,401
1883-84......	16,994	7,394	1,843	521	80	26,832	83,289
1884-85......	13,507	6,035	1,403	677	80	21,702	71,228
1885-86......	19,084	6,879	1,181	521	149	27,814	91,672
1886-87......	18,216	5,902	1,564	639	139	26,460	87,648
1887-88......	17,879	7,996	1,438	764	72	28,149	92,251
1888-89......	14,205	6,417	1,538	589	19	22,768	78,453
1889-90......	18,259	5,992	1,654	799	70	26,774	100,473
Average for 10 years...	17,491	6,878	1,585	660	76	26,681	86,162

The estimated total production of rice in 1888-89 has been given as :—

Bengal	14,269,223	tons.
Madras	2,693,916	,,
Bombay and Sind	399,757	,,
N.-W. Provinces and Oudh ..	2,420,768	,,
Punjab	271,293	,,
Central Provinces..............	1,622,385	,,
Burma	3,039,397	,,
Assam..........................	608,846	,,
	25,325,585	tons.

In the same year India imported from beyond its frontier 1,151,450 cwts., the greater portion coming from Nepaul. Of the exports, about 50 per cent. goes to Europe, 30 per cent to Eastern ports, and the remainder for the use of the emigrants in Mauritius, Rèunion, the West Indies, South America, and

Australia. The fine rice of the West Indies is considered insipid by the Indian labourers.

TRITICUM SATIVUM, *Lam.*

Fig.—*Bentl. and Trim., t.* 294. Wheat (*Eng.*), Blé (*Fr.*).

Hab.—The Euphrates region. Cultivated in N.-W. India, the Central Provinces, and Bombay.

Vernacular.—Géhun (*Hind.*), Gahun (*Mar.*), Godumai (*Tam.*), Godumulu (*Tel.*), Kotanpam (*Mal.*), Godhi (*Can.*), Gam (*Beng.*), Ghavum (*Guz.*).

History, Uses, &c.—Wheat, as the most important of the cereals, has given rise to numerous myths, for an account of which we cannot do better than refer the reader to the late Dr. W. Mannhardt's learned monograph *Die Komendämonen* (Berlin, 1868). In the myth of Persephone-kora, daughter of Zeus, the god of the heavens, which by their warmth and rain produce fertility, and of Dimeter or Ceres, the maternal goddess of the fertile earth, we perceive that she was conceived as a divine personification of this grain, in summer appearing beside her mother in the light of the upper world, but in the autumn disappearing, and in winter passing her time, like the seed under the earth, with the god of the lower world. As a pendant to the Greek myth, we have the Indian myth of Sita or "the Furrow," husbandry personified, and apparently once worshipped as a kind of goddess. In the *Rig-Veda* Sita is invoked as a deity presiding over Agriculture, and appears to be associated with Indra. In the *Vájasaneya,* Sita "the Furrow" is personified and addressed, four furrows being required to be drawn at the ceremony when certain stanzas are recited. Sita is so named because she was fabled to have sprung from a furrow made by her father Janaka while ploughing the ground to prepare it for a sacrifice instituted by him to obtain progeny, whence her epithet Ayonija "not womb-born."* Wheat was used in sacrifice by the Greeks and

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* Of course, these myths are more or less applicable to all food-grains.

Romans, and by the Hindus in Vedic times, as an emblem of fertility; it was poured upon the bride at the marriage ceremony, and in Northern India, wheat, millet and rice are still used on such occasions. Wheat, as the most important food-grain, is frequently mentioned by Hippocrates, who calls it πυρός, and mentions three kinds; Pliny also describes several kinds of *Triticum*. Sanskrit medical writers also mention three kinds of wheat, namely, Mahágodhuma or large-grained, Madhuli or small-grained, and Nihsuki or beardless; they consider it to be the most nutritive of the food-grains, but not so easily digested as rice.

Many varieties of wheat are cultivated in India, and through careless cultivation there is much mixture in the samples brought to market. A number of samples purchased by one of us in the Bombay market and sent to Australia for trial, were, on careful cultivation, found to be all mixed, some of them producing five or six distinct varieties. Indian wheats may be divided roughly into two classes, soft and hard, the former being mostly used for bread-making, and the latter for making a kind of vermicelli and certain other preparations used by the natives. Amongst the Hindus, owing to caste distinctions, the whole process of grinding the corn, separating the flour and making it into cakes, is usually performed by the women of the house, consequently the demand for ready-made flour is limited to the supply of the non-Hindu population, and some of the less particular Hindu castes. In the Indian process of making flour, the wheat, after cleaning, is placed upon a table and thoroughly wetted and the water allowed to drain from it during the night. The next morning, the still moist grain is ground in handmills by women. It is then sifted, and as much fine flour and *rawa* or *suji* (the heart of the grain) as can be obtained are laid aside. The remainder termed "*naka*" is again ground in a more powerful mill and an inferior kind of *rawa* obtained from it. The residue after a third grinding yields a coarse flour and bran. The bazar-made bread is of two kinds, that used by the Mahometans and known as *Nán*, which is in thin cakes, and loaf-bread introduced by the

Portuguese. The former is similar to the bread used in all Mahometan countries, the latter is made with 60 parts fine *rawa*, 20 second sort or *naka rawa*, and 20 of first sort flour. A second or inferior kind of bread is also sold. The barm or yeast in use is, where obtainable, the fermenting juice of the palm, elsewhere an artificial barm is prepared.

In some of the large towns a loaf-bread is now made by Brahmins for the use of the Hindu population, but its use is very limited. In Calcutta, Madras, and Bombay, flour and bread made as in Europe is obtainable, and is gradually taking the place of the Portuguese article. Fine flour is also imported from Europe and America, as the excessive proportion of gluten in Indian flour renders it unsuitable for use in making pastry.

Wheaten flour is often used as a dusting-powder to allay the heat and pain of local inflammations, such as burns, scalds, &c., but it is inferior for such purposes to powdered starch. In America an uncooked paste made of the flour has been used with success in diarrhœa. In India flour is much used by the natives for making poultices.

Description.—The albumen which constitutes the main portion of the grain is composed of large thin-walled parenchyme, the cells of which on transverse section are seen to radiate from the furrow, and to be lengthened in that direction rather than longitudinally. In the vicinity of the furrow alone the tissue of the albumen is narrower. Its predominating large cells show a polygonal or oval outline, whilst the outer layer is built up of two, three or four rows of thick-walled, coherent, nearly cubic gluten-cells. This layer, about 70 mkm. thick, is coated with an extremely thin brown tegument, to which succeeds a layer about 30 mkm. thick, of densely packed, tabular, greyish or yellowish cells of very small size; this proper coat of the fruit in the furrow is of rather spongy appearance.

The gluten-cells, varying considerably in the different cereal grains, afford characters enough to distinguish them with certainty. In wheat, for instance, the gluten-cells are in a single row, in rice they form a double or single row, but its cells are transversely lengthened.

The layer alluded to as being composed of *gluten-cells* is loaded with extremely small granules of albuminous matters (gluten), which on addition of iodine are coloured intensely yellow. These granules, which, considering barley as an article of food, are of prominent value, are not confined to the gluten-cells, but the neighbouring starch-cells also contain a small amount of them: and in the narrow zone of denser tissue projecting from the furrow into the albumen, protein principles are equally deposited, as shown by the yellow coloration which iodine produces.

The gluten-cells, the *membrane embroynnaire* of Mège-Mouriès, contain also, according to the researches on bread made by this chemist (1856), *Cerealin*, an albuminous principle soluble in water, which causes the transformation of starch into dextrin, sugar, and lactic acid. In the husks (*épiderme, épicarpe,* and *endocarpe*) of wheat, Mège-Mouriès found some volatile oil and a yellow extractive matter, to which, together with the cerealin, is due the acidity of bread made with the flour containing the bran.

Chemical composition.—König quotes 200 analyses of wheat from different sources and by various chemists, and the following figures represent the minimum, maximum, and mean composition:—

	Water.	Albuminoids.	Fat.	Nitrogen-free extractive.	Cellulose.	Ash.
Minimum..	5·33	7·61	1·00	59·90	1·24	·52
Maximum.	19·10	21·37	3·57	73·77	6·34	2·68
Mean	13·65	12·35	1·75	67·91	2·53	1·81

According to Church (*Food Grains of India*), average Indian wheat has the following percentage composition:—Water 12·5, albuminoids 13·5, starch 68·4, oil 1·2, fibre 2·7, ash 1·7. The albuminoids in some samples examined were as high as 16·7. In English and American wheat they range from 8 to 9 per cent. only. The amount of starch varies between 60 and 70 per cent., and the weight of nitrogen between 1·6 and 2·7 per cent. A small quantity of saccharine matter is also present, and the ash contains nearly 50 per cent. of phosphoric acid. The inorganic constituents are mostly found in the bran, to the extent of over 7 per cent., while the nitrogenated principles enter chiefly the flour. If the latter be kneaded with cold water as long as the liquid becomes milky, a yellowish gray elastic and glutinous mass remains, which is the *gluten* of Beccaria, retains about 70 per cent. of water, and consists, according to Von Bibra, in the dry state, of about 70 per cent. *vegetable fibrin,* 3·8 to 9·3 *vegetable casein,* 7·5 to 19·5 *glutin,* and 4·6 to 8·2 per cent. of fat. When fresh it dissolves in dilute phosphoric acid and in solution of potassa. On drying it assumes a hornlike appearance and partly loses its solubility. According to Boussingault, it contains 15 per cent. of nitrogen.

To purify it, Ritthausen (1862-67) dissolves it in cold very dilute potassa solution (1 to 1,000 parts of water), decants from the undissolved starch, and precipitates with acetic acid. The precipitate is repeatedly treated with fresh portions of alcohol, commencing with spec. gr. ·914, and increasing the strength finally to absolute alcohol. After another washing with ether, the insoluble portion constitutes *gluten-casein,* which is slightly soluble in acetic acid, freely soluble in potassa, and becomes insoluble by heat. On evaporating the united alcoholic liquids to one-half and cooling, *gluten-fibrin* is separated, which is freed from adhering casein by dissolving it repeatedly in 60 and 70 per cent. alcohol. It is freely soluble in dilute acetic acid, and when boiled with water, in which it is insoluble, it is converted into a jelly. After the separation of gluten-fibrin, the greater portion of the alcohol is evaporated; the precipitate appearing on cooling is treated with a little alcohol, washed with ether, dissolved in a little 65 per cent. alcohol, and precipitated by absolute alcohol. The precipitate is *mucedin*; the solution contains *glutin* or *gliadin.* The former yields with cold or boiling water a milk-like liquid; the latter is soluble in water, alcohol, acetic acid, potassa, &c., the aqueous solution being precipitated by the salts of the heavier metals; glutin contains sulphur and 18 per cent. of nitrogen. These principles are the most important ones of the *vegetable protein compounds.* (*Stillé and Maisch.*)

Starch forms a white, inodorous, and tasteless powder, with a peculiar slippery feel between the fingers. Exposed to the atmosphere, it contains from 10 to 13 per cent. of moisture, which is given off at 100° C. (212° F.), and is reabsorbed on exposure. The spec. grav. of starch is about 1·5, but after complete drying is increased to 1·56. It is insoluble in ether, alcohol, and cold water; the last-mentioned liquid, however, when triturated with starch, so that some of the granules are ruptured, evidently dissolves a little, since it acquires, after filtration, a blue color on the addition of iodine. *Soluble starch* is obtained, according to Maschke, by the prolonged heating of starch to 100° C. (212° F.). When heated to between 160° and 200° C. (320° and 392° F.), it is gradually converted into *dextrin* (see below). Starch becomes soluble in cold water in the presence of the chlorides of zinc and of calcium and of other deliquescent or freely soluble salts. Its solution in hot water gelatinizes on cooling, the jelly of wheat starch being milk-white—that of potato starch, particularly when made with much water, being more translucent. On heating starch with glycerin a solution is obtained, which, according to Zulkowski (1875, 1880), contains soluble starch, obtainable by diluting with water and precipitating the clear filtrate with alcohol. Potato starch is easily converted into the soluble form, but wheat starch requires a prolonged heating, and rice starch is thus changed with still greater difficulty.

Preparation.—Wheat or other grain is soaked in warm water, to which sometimes an alkali is added, until the outer coating has become soft; it is then ground under water, and washed upon suitable sieves with pure water, with which the starch passes through and is collected by subsidence in suitable tanks, the alkaline water retaining the gluten; or the latter is removed by allowing it to undergo decomposition, when acetic, butyric, or lactic and other acids are produced. The gluten need not be destroyed, but may be obtained as a by-product;

for this purpose wheat flour is made with water into a stiff dough; this is set aside for 2 hours, and then placed upon a fine wire sieve, where it is kneaded under a thin stream of water until the latter no longer becomes milky; nearly the whole of the gluten will remain upon the sieve. After sufficient washing with pure water, the starch is drained in boxes, cut into cubical blocks, and dried in properly-constructed drying chambers.

Mucilage of starch, when heated to about 160° C. (320° F.), or when boiled with very dilute sulphuric acid, or when digested with diastase at about 70° C. (158° F.), is converted, according to Musculus (1860), first into *maltose*, $C^{12}H^{22}O^{11}$, which is probably a compound of *dextrin*, $C^{6}H^{10}O^{5}$, and *dextrose*, $C^{6}H^{12}O^{6}$, the former passing finally likewise into glucose. Iodine imparts to starch in the presence of water, and to starch-mucilage, a blue color which disappears on the application of heat, but reappears on cooling. Bromine colors the starch brown-yellow. Fuming nitric acid transforms starch into *xyloidin*, $C^{6}H^{9}(NO^{2})O^{5}$, which is a white, tasteless powder, insoluble in alcohol, but softening in boiling water. A filtered solution of starch in water yields with tannin a flocculent precipitate which is soluble in boiling water. When incinerated, starch should leave not over 1 per cent. of ash.

The exports of Wheat from India to Europe last year exceeded 1,397,000 tons, an increase on the shipments of the previous twelve months of 725,000 tons, or 110 per cent., and they were larger than the previous largest shipments in any year, that of 1886, by 265,000 tons, or 23·4 per cent. In the past seven calendar years the exports from the three great shipping ports have been as under:—

Years.	From Bombay.	From Kurrachee.	From Calcutta.	Total Tons.
1891	665,543	512,632	219,221	1,397,466
1890	272,644	334,042	65,439	672,125
1889	305,044	341,137	77,637	723,818
1888	483,035	149,277	148,776	781,088
1887	462,428	32,977	229,012	724,417
1886	617,834	186,352	328,558	1,132,744
1885	542,562	307,844	212,277	1,062,683

The shipments from Bombay show an increase on the preceding year of 144·5 per cent., those from Kurrachee of 53·6, and from Calcutta of 236·9 per cent. The share of these three ports in the trade in the past two years and in 1886 has been as under :—

	1891. Per cent.	1890. Per cent.	1886. Per cent.
Bombay... ...	47·6	40·6	54·5
Kurrachee ...	36·7	49·7	15·7
Calcutta ...	15·7	9·7	29·8

Three years ago Kurrachee took the lead, and in the following year she increased it, thanks to the large crops in the Punjab, from whence she draws the bulk of her supplies. Last year the crop in the Punjab, the largest wheat-producing province in India, was a bumper one, and as the demand from Europe was more than usual, the exports from the chief port of Sind were far in excess of any previous year, and exceeded half a million tons. But she was, nevertheless, unable to maintain her supremacy. With full crops in the Central Provinces and in the North-West Provinces and Oudh, but under the average in this Presidency, Bombay once again took the lead with a total of close on 666,000 tons, or about 30 per cent. more than from Kurrachee and a 11 per cent. larger share in the total exports from the country. To the larger crop in the N.-W. Provinces and Oudh the increased shipments from Calcutta are due, for in Bengal the crop was slightly under the mean; but her future position, as an exporter of Wheat, is bound to weaken, rather than improve, on that held by the ports on the Western side. In the past seven years on an average 51 per cent. of the shipments have been despatched to Great Britain and 49 to the Continent, but last year only 41 per cent. went to U. K. Ports and 59 to the rest of Europe. Of the shipments from Bombay in 1891, the Continent received 63 per cent., from Kurrachee nearly as much—*viz.*, 61 per cent.,—but from Calcutta only 41 per cent. went. The crop now growing promises well in the Punjab and North-West Provinces, in both of which the area was recently estimated as larger than last year: in the former at about one, and in the latter at four per cent. more, or about 10¾ and 11 per cent., respectively, in excess of the normal area. In the Central Provinces and in this Presidency, the estimates, when completed, are expected to fall short of both last year and the average, owing to the season being unfavourable for the later sowings, but in Berar the area is returned at over two per cent. more than last year's. More rain is wanted, especially in the Central Provinces, Berar, and in parts of our own Presidency, and unless it soon falls the outturn will be still further reduced. A large business in Punjab Wheat was done a few months ago for April-May delivery in Bombay, but owing to the dealers in the Central Provinces holding out for new terms of sale in the local market, very little of the grain of those provinces has so far been contracted for. They have only recently given way, and agreed to sell on the old terms, too late, however, for the market has slipped back and prices have dropped considerably from their former high level.

HORDEUM HEXASTICHUM, *Linn.*

Fig.—*Duthie, Fodder Grasses of N. India, Pl. F, f.* 32. Barley (*Eng.*), Orge (*Fr.*).

Hab.—Western temperate Asia. Cultivated in the N.-W. Provinces of India.

Vernacular.—Jav (*Hind.*), Jab (*Beng.*), Java (*Mar., Tel.*).

History Uses, &c.—Indra in the *Rig-Veda* is called *durah yavasya,* "the giver of the barley." At many Hindu ceremonies, such as the birth of a child, marriages, funerals, and in various sacrifices, barley is used. In the *Atharva-Veda* the rice and barley offered to the dead are prayed to to be propitious to them, and in the same *Veda* rice and barley are invoked for the cure of disease and deliverance from other evils: "*Etau yakshmain vi bádhete; etau mun'ch'ato anhasas.*" Barley is symbolic of wealth and plenty; it is also a phallic emblem; Asvaláyana, in the first book of the *Grihyasutra,* says that in Vedic times, the wife when three months gone with child fasted; after her fast, her husband came to her with a pot of sour milk into which he threw two beans and a grain of barley, and whilst she was drinking it, he asked, "What drinkest thou?" She, having drunk three times, replied, "I drink to the birth of a son." Náráyana, in his Commentary on Asvaláyana, states that the two beans and the grain of barley represent the organs of generation. (*De Gubernatis.*)

At the Yava-chaturthi, on the fourth day of the light half of the month Vaisákh, a sort of game is played in which people throw barley-meal over each other. Yava-sura, an intoxicating drink, is made from barley in Northern India. According to Bretschneider, barley is included among the five cereals, which, it is related in Chinese history, were sowed by the Emperor Shen-nung, who reigned about 2700 B.C.; but it is not one of the five sorts of grain which are used at the ceremony of ploughing and sowing as now annually performed by the emperors of China.

Theophrastus was acquainted with several sorts of barley (κριθή), and, among them, with the six-rowed kind or *hexastichon,* which is the species that is represented on the coins struck at Metapontum in Lucania between the 6th and 2nd centuries B.C.

Barley is mentioned in the Bible as a plant of cultivation in Egypt and Syria, and must have been, among the ancient Hebrews, an important article of food, judging from the quantity allowed by Solomon to the servant of Hiram, king of Tyre (B.C. 1015). The tribute of barley paid to King Jotham by the Ammonites (B.C. 741) is also exactly recorded. The ancients were frequently in the practice of removing the hard integuments of barley by roasting it, and using the torrified grain as food. (*Pharmacographia.*)

The Hindus employ barley in the dietary of the sick. It is chiefly used in the form of *saktu* or powder of the parched grain. Gruel prepared from *saktu* is said to be easily digested and to be useful in painful dyspepsia. In Europe, for use in medicine and as food for the sick, pearl-barley is always employed; this is the grain deprived of its husk by passing it between horizontal mill-stones, placed so far apart as to rub off the integuments without crushing it. Pearl-barley imported from Europe is obtainable in most Indian bazars. For an account of the economic uses of barley, we would refer the reader to an article by Dr. J. Murray in the *Dict. Econ. Prod. of India* (iv., p. 273).

Description.—The structure of the barley-grain after the paleæ have been removed is similar to that of wheat (see *Triticum*). The paleæ consist chiefly of long fibrous, thick-walled cells, two or four rows deep, constituting a very hard layer. On transverse section, this layer forms a coherent envelope, about 35 mkm. thick; its cells, when examined in longitudinal section, show but a small lumen of peculiar undulated outline from secondary deposits. (*Pharmacographia.*)

Chemical composition.—The following figures representing the average minimum, maximum, and mean composition of 127 samples of barley from different sources are quoted by König:—

	Water.	Albuminoids.	Fat.	Nitrogen-free extract.	Cellulose.	Ash.
Minimum ...	7·23	6·20	1·03	49·11	1·96	·6
Maximum...	20·88	17·46	4·87	72·20	14·16	6·92
Mean ...	13·77	11·14	2·16	64·93	5·31	2·69

According to Church, the average percentage composition of husked Indian barley is, water 12·5, albuminoids 11·5, starch 70·0, oil 1·3, fibre 2·6, ash 2·1.

Lermer (*Vierteljahresschr. für prakt. Pharm.*, XII. (1863), 4-23) found European barley to have the following percentage composition:—Water 13 to 15, oil 3·0, starch 63·0, cellulose 7·0, dextrin 6·6, nitrogen 2·5, ash 2·4, lactic acid a trace. The protein or albuminous matter consists of different principles, chiefly insoluble in cold water. The soluble portion is partly coagulated on boiling, partly retained in solution. 2·5 per cent. of nitrogen, as above, would answer to about 16 per cent of albuminous matters. Their soluble part seems to be deposited in the starch-cells, next to the gluten cells, which latter contain the insoluble portion.

The ash, according to Lermer, contains 29 per cent. of silicic acid, 32·6 of phosphoric acid, 22·7 of potash, and only 3·7 of lime. In the opinion of Salm-Horstmar, fluorine and lithia are indispensable constituents of barley.

The fixed oil of barley, as proved in 1863 by Hanamann, is a compound of glycerine, with either a mixture of palmitic and lauric acids, or less probably with a peculiar fatty acid. Beckmann's *Hordeinic Acid* obtained in 1855 by distilling barley with sulphuric acid is probably lauric acid. Lintner (1868) has shown barley to contain also a little *Cholesterin*.

Lastly, Kühnemann (1875) extracted from barley a crystallized dextrogyrate sugar, and (1876) an amorphous lævogyrate mucilaginous substance, *Sinistrin*; according to that chemist, dextrin is altogether wanting in barley.

Barley when malted loses 7 per cent.; it then contains 10 to 12 per cent. of sugar, produced at the expense of the starch; before malting no sugar is to be found. (*Pharmacographia.*)

Commerce.—The total yield of barley in British India does not exceed 50,000,000 cwts. In 1887-88 the total exports were 29,575 cwts., valued at Rs. 89,776, of which Bombay shipped 18,688 cwts., Bengal 6,873 cwts., and Sind 4,014 cwts., valued at Rs. 58,632, Rs. 20,556, and Rs. 10,588, respectively. The country which imported most largely was Persia, with 10,358 cwts.; following on which were, Arabia with 7,675 cwts., Ceylon with 7,539 cwts., and Aden, the United Kingdom, Zanzibar, and "other countries" with insignificant quantities. (*Dict. Econ. Prod. India*, iv., p. 281.)

The minor food grains (*Kudhánya* or *Kshudar dhánya*) mentioned by Sanskrit medical writers are:—

Sorghum vulgare, *Pers.*—Yávanála (*Sanskrit*), Joár (*Hind.*, *Beng.*), Javári (*Guz.*), Jondhalá (*Mar.*), Cholum (*Tam.*), Talla (*Tel.*), Chavela (*Mal.*).

This is one of the most important food-crops of India; from it are made bread, porridge, and other food preparations. Church's analysis shows it to have the following percentage composition:—Water 12·5, albuminoids 9·3, starch 72·3, oil 2·0, fibre 2·2, ash 1·7, phosphoric acid 0·85, potash 0·21.

Setaria italica, *Beauv.*—Kangu (*Sanskrit*), Kora (*Hind.*), Kángni (*Beng.*), Káli-kángani (*Mar.*), Bájri (*Guz.*), Tennai (*Tam.*), Korálú (*Tel.*).

The grain is much esteemed as an article of human food in some parts of India. It is eaten in the form of cakes and porridge in the North-West Provinces and Bombay; in Madras it is valued as a material for making pastry, in the Punjab the leaves are used as a pot-herb. Boiled with milk it forms a light and pleasant meal for invalids. Church's analysis shows it to have the following percentage composition:—Water 10·2, albuminoids 10·8, starch 73·4, oil 2·9, fibre 1·5, ash 1·2 (husked).

Panicum miliaceum, *Linn.*—Chína (*Sanskrit*), Chína (*Hind.*), Chína-ghás (*Beng.*), Varagu (*Tam.*), Vorglo (*Tel.*), Varivava (*Mar.*).

This grain is usually made use of in the form of porridge. Church's analysis shows it to have the following percentage composition:—Water 12·0, albuminoids 12·6, starch 69·4, oil 3·6, fibre 1·0, ash 1·4 (husked).

Panicum frumentaceum, *Roxb.*—Syámáka (*Sanskrit*), Sawan (*Hind.*), Shyámádhán (*Beng.*), Shamálu (*Tel.*), Kathli, Shamúla (*Mar.*), Savan, Sama (*Guz.*).

This grain is wholesome and nourshing, and is much used for home consumption amongst the poorer classes. Church's analysis shows it to have the following percentage composition:—Water 12·0, albuminoids 8·4, starch 72·5, oil 3·0, fibre 2·2, ash 12·9 (unhusked).

Paspalum scrobiculatum, *Linn.*—Kodrava (*Sanskrit*), Koda (*Hind.*), Kodoádhán (*Beng.*), Arugu (*Tel.*), Gora-harik, Gora-kodru (*Mar.*, *Guz.*).

Cases of poisoning are occasionally met with in India, arising from the consumption of this grain as an article of food. The symptoms are similar to those seen in poisoning by darnel (see *Lolium temulentum*). Kodru-poisoning occasionally ends fatally: thus, in a case reported to the Bombay Chemical Analyser, from Godhra, in 1879-80, four persons, *viz.*, a man and three children, were poisoned by eating bread made from the flour, and one of the children died. This grain appears to be only occasionally poisonous; according to popular belief, there are two varieties of the grain, Gora or "sweet," and Májara or "poisonous."

Church's analysis shows the following percentage composition of the husked grain:—Water 11·7, albuminoids 7·0, starch 77·2, oil 2·1, fibre 0·7, ash 1·3.

Hygrorhiza aristata, *Nees.*—Nivára (*Sanskrit*), Uridhán (*Hind., Beng.*), Deobhát (*Mar.*).

See article on Rice. Church's analysis shows that wild rice, after it has been husked, has the following percentage composition:—Water 12·8, albuminoids 7·3, starch 78·3, oil 0·6, fibre 0·4, ash 0·6.

Eleusine corocana, *Gärtn.*—Rági (*Sanskrit*), Mandua, Mandal (*Hind.*), Marua (*Beng.*), Kayur (*Tam.*), Ponassa (*Tel.*), Rági (*Can.*), Náchni, Nágli (*Mar.*).

This grain is much used by the poorer classes in Western India, usually in the form of porridge. It is considered to be particularly wholesome and digestible, and a thin gruel made from it is much used mixed with cow's milk for weaning children and as a diet for invalids. In Goa thin biscuits are prepared with the flour, from which a gruel can at once be made.

Church's analysis shows the grain to have the following percentage composition:—Water 13·2, albuminoids 7·3, starch 73·2, oil 1·5, fibre 2·5, ash 2·3, phosphoric acid 0·4.

Sorghumsac charatum, *Mœnch.*—Devadhánya (*Sanskrit.*), Deodhán (*Hind.*, *Beng.*), Shálu (*Mar.*), Iniphi (*Guz.*).

A food grain of much value. Church's analysis shows it to have the following percentage composition:—Water 12·8, albuminoids 11·8, starch 68·3, oil 3·0, fibre 3·0, ash 1·1, sugar 6 to 18.

Saccharum sara, *Roxb.*—Cháruka (*Sanskrit*), Sarpa, Sara (*Hind*), Sarabij (*Beng.*), Gundra, Sura (*Tam.*, *Tel.*), Sara (*Mar.*).

The seed of this grass appears to be only used in famine times, or by some of the wild tribes who use the stem for making arrows.

The seeds of Coix and Bambusa, which are also classed amongst the *Kshudra-dhánya*, have been already noticed.

Festuca indica (Rheede, xii., 45) is used to resolve phlegmons.

FILICES.

POLYPODIUM VULGARE, *Linn.*

Fig.—*Eng. Bot.*, 1149; *Woodv. Suppl.*, *t.* 271. Common Polypody (*Eng.*), Polypode de chêne (*Fr.*).

Hab.—Persia, Europe. The rhizomes.

Vernacular.—Basfaij (*Ind. Bazars*).

History, Uses, &c.—This fern is the πολυπόδιον of Theophrastus and Dioscorides, both of whom mention its purgative properties. Dioscorides states that it is used to expel bile and phlegm. Pliny (26, 37) says:—" The root of polypadion, known to us as *filicula*, is used medicinally, being fibrous and of a grass-green colour within, about the thickness of the little finger, and covered with cavernous suckers like those on the arms of the polypus. It is of a sweetish taste, and is found growing among rocks and under trees. The root is steeped in water, and the juice extracted; sometimes, too, it is cut in small pieces and sprinkled upon cabbage, beet, mallows, or salt meat; or else it is boiled in pap as a gentle aperient for the bowels. It carries off bile and the pituitous humors, but acts injuriously upon the stomach. Dried and powdered and applied to the nostrils, it cauterizes polypus of the nose. It has neither seed nor flower. In Germany there was a myth in ancient times that the plant sprang from the milk of the goddess Freya, and in more recent times the Virgin Mary was credited with its origin. Owing to the sweetness of the rhizome, it is, in some parts of France, called "reglisse" or "liquorice."

The Persians call the plant Tashtiwán and Baspáík; the latter name in the Arabic form of Basfaij is now current throughout the East as the name of the drug, and is used by Ibn Sina and the Arabian physicians. The Arabian names for the plant are, Azrás-el-kalb "dog's tooth," in allusion to the toothed appearance of the leaves, Kathir-el-rijl "many-footed," and Thákib-el-hajar "penetrating stones." The Mahometan physicians use it as an aperient, deobstruent, and alterative combined with myrobalans and fumitory; they consider that it acts as an expeller of all kinds of peccant humors; for instance, we have seen it prescribed in cataract and amaurosis by Indian hakims. It is not an article of the Hindu Materia Medica.

Description.—The dried rhizome occurs in pieces of various lengths, and of the thickness of a quill. It is flattened, of a yellowish-brown colour externally, green internally, but when old yellowish; the upper surface is studded with tubercles, to some of which a portion of the base of the frond still adheres. The under surface is more or less spinous from the remains of broken radicles. The taste is sweetish, astringent, nauseous, and somewhat acrid; odour ferny. Under the microscope, the rhizome is seen to consist of a delicate cellular structure containing much starch and green granular matter; it is traversed by large bundles of scalariform vessels.

POLYPODIUM QUERCIFOLIUM, *Spr.*

Fig.—*Rheede, Hort. Mal. xii., t.* 11. Oak-leaved Polypody (*Eng.*).

Hab.—India. Widely distributed throughout the East. The rhizome.

Vernacular.—Báśing, Vándar-báśing, Ashva-kátri (*Mar.*).

History, Uses, &c.—Báśing (बाशिंग), the Marathi name of this remarkable fern, signifies the crown-like frontlet which the Marathi people tie upon the forehead of the bride and bridegroom at the marriage ceremony. There can be little doubt that the form of the ornament was suggested by the appearance of the plant; its use is of very ancient date, and probably derived from the aboriginal inhabitants of the hilly districts of Western India, where *P. quercifolium* is very abundant. The thick silky rhizome of this fern is found closely adhering to the dead branches of trees, which it envelopes with its large oak-like leaves. Rheede says that the plant is supposed by the natives of Malabar to partake of the properties of whatever tree it grows upon. This notion prevails all over India with regard to this and other parasites (see *Loranthaceæ*), and, as has already been shown, is quite erroneous.

For medicinal purposes those plants which grow upon the *Strychnos Nux-vomica* are preferred. The author of the *Wanaushadi Prakásha* gives the following prescription containing Báśing as the best cure for phthisis:—Take 2 tolás of Kájrabásing, 1 tolá Ooksi flowers (*Calycopteris floribunda*), 2 tolás Chiretta, 2 tolás Ghás-pitpapra (*Rostellularia procumbens*), 2 tolás Ringan-múl (root of *Solanum indicum*), 2 tolás Bál-bel-phal (small immature fruit of *Ægle Marmelos*), 2 tolás Padminimúl (root of *Nelumbium speciosum*), 4 tolás Sonar-wel-múl (root of *Vicoa indica*), two tolás Gokhru-múl (root of *Tribulus terrestris*). These nine drugs are to be powdered and divided into seven parts. For administration each part is to be boiled in 40 tolás of water, sweetened with 2 tolás of sugar-candy, and the decoction (kára) boiled down to one-eighth; this is to be taken in the morning, and the marc is to be again treated in the same manner to furnish the nikára (second decoction) or evening dose. The same prescription is recommended in hectic fever from whatever cause, and in dyspepsia and cough; during its use potatoes and indigestible vegetables are to be avoided.

Rheede (xii., 12, 13) has the following remarks upon the medicinal use of *Polypodium taccifolium* in Malabar:—"Succus radicis vermes enecat, bilem sistit et temperat. Folia in pulverem redacta cum melle assumpta secundinas, menses, imo fœtum ipsum fortiter ejiciunt; mulieres ergo cavete vobis."

ADIANTUM VENUSTUM, *Don.*

Fig.—*Hook. Sp. Fil. ii*, 40; *Bedd. Ferns. Brit. Ind. xx.*

Hab.—Himalaya, Afghanistan, Persia. The plant.

Vernacular.—Hansráj, Mobarkha (*Ind. Bazars*).

History, Uses, &c.—Under the name of ἀδίαντον a fern is described by Dioscorides as having leaves serrated at the top like coriander (φυλλάρια ἔχει κοριάνδρῳ ὅμοια ἐπεσχισμένα επ ἄκορον). _This plant was doubtless *Adiantum Capillus Veneris*, *tum*, the same description would apply equally well to *A. venus*- but which has been adopted by the Mahometan physicians of the East as representing the ἄδιαντον of the Greeks. The Western Arabs, however, appear to use *A. Capillus Veneris*, as they call the plant Kuzburat-el-bir or "coriander of the well," indicating a habitat where *A. venustum* is not found. Other Arabic names for the genus *Adiantum* are Shaar-el-jinn "fairies' hair," Shaar-el-jibal "hair of the mountains," Shaar-el-fual "hair of omens," Sák-el-aswad "black stem," Nasif-el-aswad "black veil," &c. Ibn Sina and other medical writes describe the drug under the name of Barsiawashán, which is the Arabian form of the Persian name Parsiawashán. It is considered to be deobstruent and resolvent, useful for clearing the *primæ viæ* of bile, adust bile, and phlegmatic humors; also pectoral, expectorant, diuretic, emmenagogue, and alexipharmic. Used as a plaster it is considered to be discutient, and is applied to chronic tumours of various kinds. The author of the *Burhán* states that the ashes of the plant mixed with olive oil and vinegar are used to make the hair grow upon the bald patches produced by ringworm of the scalp. Theophrastus (*H. P.*, vii., 13) mentions two kinds of *Adiantum*, "white" and "black," used in making hair oil. Greek synonyms for the plant were *politrichon*, *calitrichon*, *trichomanes*, and *ebinotrichon*.

In France a syrup of Maiden-hair is much used as a pectoral; the officinal plant is *A. pedatum*, Linn., or Capillaire du Canada, but *A. trapeziforme*, Linn., Capillaire du Mexique, is allowed as a substitute.

Description.—Fronds 3 to 4 times pinnate. Rachis slender, polished, naked; segments rigid, prominently veined and toothed, upper edge rounded, lower cuneate into the petiole; *sori* one to three, large, roundish, placed in a distinct hollow on the upper edge.

Commerce.—The Maiden-hair of commerce consists solely of *A. venustum*, imported from Persia in large bales which contain a number of small bundles, five or six of which weigh one pound. Value, 3 annas per lb. Other species of *Adiantum* are used locally to a small extent.

ASPLENIUM PARASITICUM, *Willd.*

Fig.—*Rheede, Hort. Mal. xii.*, *t.* 17.

Vernacular.—Kári-béli-pánna-maravara (*Mal.*), Mahá-pána (*Mar.*), Káli-pándan (*Goa*).

ASPLENIUM FALCATUM, *Willd.*

Fig.—*Rheede, Hort. Mal. xii.*, *t.* 18.

Hab.—India. The rhizomes.

Vernacular.—Nela-pánna-maravara (*Mal.*), Pána (*Mar.*), Pándan (*Goa*).

History, Uses, &c.—The medicinal use of these ferns is due to the Portuguese, who, on their settling in India, adopted them as substitutes for *Asplenium* of Europe.

A fern called ἄσπληνον or ἄσπληνος πόα was supposed by the ancients to have the property of reducing the size of the spleen; it was also known as σκολοπένδριον "centipede plant," from a fancied resemblance of its fronds to that reptile, and ἡμιόνιον "mule plant," because mules were reputed to be fond of feeding upon it. Dioscorides mentions the use of a decoction of the plant in vinegar for enlargement of the spleen, and also the local application of a plaster made of the leaves steeped in wine. It was also considered to be of use in incontinence of urine, calculus, and jaundice. Women were not allowed to use it, as it was supposed to cause sterility. This plant is generally identified with the *Asplenium Ceterach* of Linneus, "Spleen-wort" or "Milt waste"; others have supposed it to be *A. hemionitis*, Linn., "Mules' fern," or *A. Scolopendrium*, Linn., "Hart's tongue."

Mahometan physicians, under the name of Iskúlúkandriún, give a translation of what Dioscorides says concerning this drug, with a few unimportant additions; practically they appear to know nothing about it, and we have never known any drug to be offered under this name in the bazars. Haji Zein states that it is called Hashishat-el-tihál "Spleen-wort" in Arabic, and in Egypt Kaf-el-nasar "Eagle's clan."

The Indian substitute is used in Goa as an alterative in cases of prolonged malarial fever, usually in combination with Oldenlandia or Andrographis, and the use of the drug has spread to Malabar through the Goan Brahmins who have settled there.

Description.—The part used medicinally is the rhizome, to which are attached the bases of the fronds and numerous radicles, all of a black colour. The rhizome is about as thick as the finger; when broken across it is seen to consist of a parenchyma in which are several bundles of vessels of a lighter colour. These can be separated from the canals in which they are situated without much trouble when the rhizome is fresh.

Under the microscope, the cell-walls of the parenchyma appear of a dark-brown colour, and the vascular bundles are seen to consist of large scalariform vessels. It has an astringent and slightly bitter taste.

Actinopteris dichotoma, *Bedd. Vern.*—Mor-pankhi, Mayuraka. A fern which grows in the Nilgiri and Himalaya Mountains, and upon rocks and old walls in the Deccan, but is rare in the plains of India; it is used as a styptic. "*Actinopteris* is a genus of polypodiaceous fern of the section Asplenieæ, and consists of curious little plants like miniature fan palms. The technical peculiarities of the genus among the Asplenieæ consist in the simple distinct indusia, free veins, and linear-elongate sori, which are marginal on the contracted rachiform segments of the small flabelliform fronds." (*T. Moore in "Treasury of Botany."*) Atkinson states that this fern is used as an anthelmintic.

LICHENES.

PARMELIA KAMTSCHADALIS, *Esch.*

Hab.—Himalaya, Persia.

PARMELIA PERLATA, *Esch.*

Fig—*Eng. Bot.*, 341.

Hab.—India, Europe, Africa. The plant.

Vernacular.—Charéla, Charcharéla, Pathar-ke-phúl, Silá-bák (*Hind.*), Motha-dagada-phúl, Bárik-dagada-phúl (*Mar.*), Ghabilo, Chadila (*Guz.*), Kalpasi, Kalapu (*Tam.*), Ratipanché (*Tel.*).

History, Uses, &c.—Two lichens are found in all Indian bazars, which are known as the greater and lesser "stone-flowers" in the vernaculars, and in Sanskrit as Silá-valká or "rock-bark." Similar plants were known to the Greeks as βρύον and σφάγνος, and to the Romans as Muscus. Dioscorides (i., 22) notices their medicinal properties, also Pliny (xii., 61). The Arabs call them Ushnah, a name derived from the

Persian, and Hazáz-el-sakhar "rock-scab." Leith says:—"It is a thing that spreads itself upon the trees called *Balút* and *Sanúbar* (oak and pine) as though it were pared off from a root (کانہ مقشور من عرق); and it is sweet in odour, and white." (*Kámús.*) In Persia these lichens are known as Ushnah and Dowálah. The author of the *Makhzan-el-Adwiya* states that Ushnah grows upon the oak, cypress, and other trees; that which is whitest should be preferred; it should have an agreeable odour. He describes it as astringent, resolvent, and aperient, and says that the decoction is used as a tonic and alterative; when burnt, the smoke relieves headache, the powder is a good cephalic snuff. Externally the drug has emollient and astringent properties, and may be used in a bath or as a poultice, &c. The dry powder is applied to wounds and sores to promote granulation. Honigberger mentions the use of the drug at Lahore in disorders of the stomach, dyspepsia, vomiting, pain in the liver or womb, induration of the uterus, amenorrhœa, calculi, and nocturnal spermatic discharges.

Ainslie (ii., 170) says: "*Kull-pashie* is the Tamool name given to a dried pale-coloured rock moss, which the Vytians suppose to possess a peculiar cooling quality, and prepare with it a liniment for the head."

The use of these lichens in the form of a poultice, placed over the renal and lumbar regions to produce diuresis, is noticed in the *Pharmacopœia of India*.

FUNGI.

MYLITTA LAPIDESCENS, *Horan.*

Fig.—*Trans. Linn. Soc., vol. xxiii., t.* 9, p. 97.

Hab.—India and China.

Vernacular.—Carom-pallagum (*Tam.*), Luy-wan (*China*).

History, Uses, &c.—This curious underground fungus is supposed to be allied to the truffles, and is used in Southern

India as medicine and food. In 1860 Dr. E. J. Waring forwarded to Mr. Hanbury some specimens of these tuberiform productions, and they were examined by Mr. M. J. Berkeley and Mr. Currey. These specimens had been dug out from the chalk-beds in the mountains between Travancore and Tinnevelly, and the hill-people were in the habit of bringing them into Trevandrum for sale. They are much esteemed by native doctors for various complaints, and they are regarded as diuretic. The Tamil name signifies Black Pallagum, Pallagum meaning a medicinal substance. The fungus frequently appears on the Nilgiris, and the Badagas, Karumbars, and other hill-tribes call it "God's bread" or "Little man's bread," and use it for food. In 1889 the Peziza was very plentiful in the Government Cinchona Plantations at Naduvatam, and the specimens were found over a wide area about one foot beneath the surface of the ground. Planters on other parts of the hills have noticed their periodical occurrence in their estates, and the coolies always collect and cook them for their meals.

Description.—These fungoid bodies are like small tubers having a black, finely-wrinkled surface, and the inside is white and marked with veins, and a microscopic section shows the division of the tissue into *areolæ* similar to that exhibited by hypogæous fungi. In a fresh state they have a waxy consistence, but when dry they are hard and horny. Some fresh slices immersed in glycerine for several weeks showed no crystalline or crystalloid formations, and starch was entirely absent.

Chemical composition.—The dried Peziza yielded 1 per cent. of carbonated ash. Boiled with dilute hydrochloric acid a solution was formed, reducing Fehling's test and inactive towards polarised light. Boiled with soda a large quantity of pectinous matter was dissolved.

BOLETUS CROCATUS, *Batsch.*

Hab.—India, on the Jack-tree (*Artocarpus integrifolia,* Linn.).

Vernacular.—Phansámba (*Bazars*), Phanas-alombé (*Mar*).

History, Uses, &c.—The only notice of this fungus, which we have met with, occurs in Rumphius (*Hort. Amb.*, i., 25), where he says:—"In Malabara ac Zeylana ex eodem quoque succo circa radices colligitur et concrescit in terra massa, seu tuber Portugallis *Isca de Jaca* (tinder of the Jack-tree) dictum, quod molle est et intus flavescit, quod natio ista pro experto habet medicamento contra diarrhœam, ad paucas vero tantum colligitur arbores, atque inde venale in alias quoque transfertur regiones." It appears to be probable that the medicinal use of this fungus was introduced into the East by the Portuguese, who adopted it as a substitute for the *Boletus fomentarius* of Linneus, the *Agaricus Chirurgorum* or "surgeon's agaric" of the old European Pharmacopœias, which the Portuguese call Isca de ferir "wound tinder," and the French Agaric de chêne or Polypore ongulé. It is the Spunk or Touchwood of the English.

In Western India the fungus is ground to a paste with water and applied to the gums in cases of excessive salivation. It is also applied to the mouths of children suffering from aphthæ, and is given internally in diarrhœa and dysentery.

Description.—In form this fungus closely resembles the European Boletus above referred to, and resembles the hoof of a horse. Internally it is of a rich orange-brown colour when fresh, and has a sweetish, styptic taste, but when long kept it turns to a dull brown colour. The fungus consists of a number of laminæ upon the under surface of which the hymenium is situated.

Chemical composition.—A proximate analysis yielded :—

Ether extract	·78
Alcoholic extract	1·60
Aqueous extract	4·10
Alkaline extract	21·34
Crude fibre	53·98
Ash	4·30
Moisture	13·90
	100·00

The ether and alcoholic extracts consisted of red-coloured resins, but no fatty matter. The aqueous extract contained 2·42 per cent. of an organic acid not related to tannin in its reaction with ferric chloride and gelatine. Solution of soda removed an acid resin having some of the properties of polyporic acid.

POLYPORUS OFFICINALIS, *Fries.*

Fig.—*Guibourt, Hist. Nat. ii.*, 45; *Pereira, Mat. Med. ii.*, Pt. 1, p. 54. Larch Agaric (*Eng.*), Polypore du Mélèze, Agaric blanc (*Fr.*).

Hab.—Southern Europe, Asia Minor. On the Larch. The fungus.

Vernacular.—Ghárikún (*Indian Bazars*).

History, Uses, &c.—The use of this fungus in medicine is of very ancient date. Dioscorides (iii., 1) describes ἀγαρικόν as male and female, the female being the best and having internally a comb-like structure, whilst the male is convolute, round and compact (συμφυες); both have the same taste, at first sweet, afterwards bitter. He states that it grows in Sarmatia, Galatia in Asia, and Cilicia, and that some suppose it to be a root and others a fungus. It is astringent, hot, and purgative, and is also given in fever, jaundice, nephritis, uterine obstructions, phthisis, dyspepsia, hæmorrhage, and pains in the joints; it is alexipharmic. Pliny (25, 57) says: "Agaric is found growing in the form of a fungus of a white colour, upon the trees in the vicinity of the Bosporus. It is administered in doses of four oboli, beaten up in two cyathi of oxymel. The kind that grows in Galatia is generally looked upon as not so efficacious. The male* agaric is firmer than the other, and more bitter; it is productive, too, of headache. The female plant is of a looser texture; it has a sweet taste at first, which speedily changes into a bitter flavour."

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* This distinction into male and female is no longer recognized, though it continued to be so till within the last century. (*Bostock.*)

Pereira states that the drug appears in the modern Greek Pharmacopœia under the name of ἀγαρικόν τὸ λευκον with the Turkish synonym of κατρὰν μανταρι.

Ibn Sina insists upon the great efficacy of agaric (غاريقون) as an alexipharmic. He and other Mahometan physicians closely follow the Greeks in their description of its medicinal properties; they consider that it removes all kinds of visceral obstructions and expels diseased humors; the female kind should be used after it has been rubbed through a hair-sieve and all black particles removed. The use of agaric in phthisis is of ancient date; it was revived by De Haen, Barbut, and others in the present century, and subsequently decried by Andral (*Phil. Trans.*, Vols. 48 and 49). The active principle, agaricin, has recently been recommended in doses of $\frac{1}{12}$ to $\frac{1}{6}$ of a grain as an astringent to check night-sweating and diarrhœa, to diminish bronchial secretion, and to dry up the milk after weaning.

Description.—Pileus corky-fleshy, ungulate, zoned, smooth. Pores yellowish. Berkeley describes the hymenium as concrete with the substance of the pileus, consisting of subrotund spores with their simple dissepiments. The drug is decorticated, dried, and bleached, and occurs in white, friable pieces, from the size of the fist to that of a child's head, which are more or less ungulate or of the shape of half a cone, with a feeble fungous odour and bitter acrid taste. The fungus, when met with in its natural state, has an external yellowish or reddish-grey coat.

Chemical composition.—White Agaric has been analysed by Bouillon-La-Grange, by Bucholz, by Braconnot, and by Bley. The constituents, according to Bley, are: resin, 33·1; extractive, 2; gum and bitter extractive, 8·3; vegetable albumen, 0·7; wax, 0·2; fungic acids, 0·13; boletic acid, 0·06; tartaric and phosphoric acids, 1·354; potash, 0·329; lime, 0·16; ammonia and sulphur, traces.

The active principle of Agaric has usually been said to reside in the resin, but a white amorphous bitter powder (laricin) has been separated from it, the formula of which, according to Will, is $C^{14}H^{12}O^{4}$. Martius considers this to be the active principle. Fleury (*J. Pharm. Chim*, (4) XXI., 279 to 284) gives the following result of an examination of the drug:—Five hundred and eighty grams of the powdered fungus, not previously dried, were exhausted successively with ether, alcohol, cold water, boiling water, water acidulated with hydrochloric acid, and water rendered alkaline with potash, and the resulting solutions were examined:—

1. The ether extracts a resin, and a body to which the name of Agaric acid is given. The examination of several salts of this acid yielded results so discordant that no definite formula could be obtained, but the nearest approaches to accuracy lead to the supposition that its formula may be $C^{24}H^{44}O^{7}$. Efforts made to determine the basicity of the acid were unsuccessful. It is shown that the addition of the elements of water to the resin represents the composition of the agaric acid. After heating with very dilute sulphuric acid, a substance is yielded which reduces the cupro-potassic liquor. The agaric acid amounts to about one-fifth of the weight of the fungus.

2. The alcoholic solution has a very red colour, due apparently to the air, and on evaporation yields a residue of the consistence of hard wax, from which ether dissolves a resinous body soluble in alkaline liquids; its reaction is acid, it is not crystallizable, and it contains 1·5 per cent. of nitrogen. It combines with metallic oxides. The remainder behaves like a resin; it is reddish, nitrogenized, fusible below 100°, forms viscous solutions with alkalies, and gelatinous precipitates with other bases.

3. Cold water yields a red solution, which on concentration deposits calcic and possibly also magnesic oxalate in microscopic crystals, while the solution contains a brown resinous nitrogenous body, considered to be identical with Boudier's viscosin.

4. Boiling water extracts a small quantity of a nitrogenous substance.

5. Water acidulated with hydrochloric acid (2 per cent.) yields a yellowish solution containing lime, iron, magnesia, and oxalic, phosphoric and malic acids.

6. Water containing 2 per cent. of potash yielded a solution, which, on treatment with hydrochloric acid, deposited a flocculent substance unacted upon by acetic or phosphoric acids, and containing 3·12 per cent. of nitrogen.

The remainder, after this treatment, is a whitish flocculent substance; on drying at 100° it blackens and coheres, yet its microscope appearance does not differ from the original aspect of the fungus. It contains 1·21 per cent. of nitrogen, and affords on calcination 2 per cent. of ash containing lime, iron, magnesia (chiefly), potash, and sulphuric and phosphoric acids. The body possesses all the properties of fungin.

The following is the tabulated result of the analysis:—

	Water	9·200
1.	Resin and agaric acid	60·584
2	Another resin with magnesia sulphate ...	7·282
3.	Resinous body with lime and magnesia ...	2·514
4.	Nitrogenous substance with salts	1·900
5.	Oxalate, malate, and phosphate of calcium, iron, &c.	1·058
6.	Nitrogenous substance soluble in potash ...	7·776
	Fungin	9·686
		100·000

Schmieder has found that this fungus contains from 4 to 6 per cent. of a fat which is not a glyceride. He obtained from it a crystalline substance having a composition represented by the formula $C^{10}H^{16}O$, which he terms "agaricol." The liquid portion of the fat yields no glycerine on saponification, but cetyl-alcohol and another alcohol together with two hydrocarbons, while the fat acid with which the alcohols are naturally combined appears to resemble ricinic acid (*Rep. of "Naturforscher and Aerzte" Meeting at Berlin,* 1886).

ALGÆ.

GELIDIUM CARTILAGINEUM, *Gaill.*
GELIDIUM CORNEUM, *Lam.*

Vernacular.—Chini-ghás (*Ind. Bazars*).

History, Uses, &c.—This substance, called Yang-tsai by the Chinese, and known in Europe as Mousse de Chine, Agar-agar, Thao, or Japanese Isinglass, is prepared from the two species of Gelidium placed at the head of this article, and also probably from *Sphærococcus compressus*, Ag., and *Gloiopeltis tenax*, I. Ag. Hanbury (*Pharm. Journ.* (II.), Vol. I., p. 508) gives the following account of it:—"Under the incorrect name of *Japanese isinglass*, there has been lately imported into London from Japan, a quantity of a substance having the form of compressed, irregularly four-sided sticks, apparently composed of shrivelled, semi-transparent, yellowish-white membrane; they are eleven inches long by from 1 to 1½ inches broad, full of cavities, very light (each weighing about 3 drachms), rather flexible but easily broken, and devoid of taste and smell. Treated with cold water, a stick increases greatly in volume, becoming a quadrangular, spongy bar, with somewhat concave sides 1½ inches wide. Though not soluble in cold water to any important extent, the substance dissolves for the most part when boiled for some time, and the solution, even though dilute, gelatinizes upon cooling. The substance under notice is used by Europeans in China as a substitute for true isinglass, for which many of its properties render it highly efficient. That which is perhaps most distinctive is its power of combining with a very large proportion of water to form a jelly. This property is due to the principle named by M. Payen *Gélose*, of which the Japanese sea-weed product mainly consists. The jelly formed by boiling this sea-weed product or crude Gélose in water, and allowing the solution to cool, requires a high temperature for fusion, differing in this respect from a jelly made of isinglass, which readily fuses and dissolves in warm water.

This substance has attracted considerable attention in France. It was exhibited at the Paris Exhibition of 1878 under the name of Thao. The following particulars from the Catalogue may prove interesting. Various trials have been made with it in France since 1874, especially by MM. D. Gantillon & Co. at Lyons, and the Industrial Society at Rouen. The thao is prepared for use in the following way:—After having been soaked in cold water for about twelve hours, it is boiled for a quarter of an hour, during which it absorbs about 100 times its weight of water. If allowed to cool it becomes a jelly, but if passed through a sieve and stirred until cold, it remains fluid, and in this state is more easily employed than when hot. The yellowish matter which some specimens contain can be removed by boiling for some time, when it forms an insoluble scum, which appears to consist of very thin fibres, and which remain attached to the sides of the vessel.

A singular property, and one which perhaps might be turned to valuable account, is, that thao jelly does not decompose solution of permanganate of potash even when left in contact with it for twenty-four hours.

According to M. Heilmann, of Rouen, thao produces, in the proportion of 1 part to 100 of water, a dressing, which is supple and strong, and which gives substance rather than stiffness to calico, while dextrine, like starch, makes the tissue drier and harder, and gives less facing to the thread. The addition of glycerine gives a dressing still more flexible and soft, and, while rendering the tissues less stiff, it communicates more body to them.

The addition of talc gives still greater smoothness. Once dissolved, according to M. Gantillon, thao will mix while hot with any gum, starch, dextrine or gelatine. The principal advantage of thao in dressing silk fabrics is that while preserving their suppleness it gives them greater glossiness and makes them soft to the touch. The mixture of thao with gum tragacanth is said to be the best method of using it. Thao should, however, be used alone for materials which it is not necessary should be stiffened. As thao is only soluble at a high temperature, a moist atmosphere, fog, or even rain does not affect the material dressed with it.

It combines well with sulphate of copper and the chlorides of aniline and potassium, and can be used in double dyeing.

It also answers well for sizing paper, &c. The only obstacle to its extensive use is its high price. There is, however, no reason why a similar substance should not be made from our common native sea-weeds, of which *Gelideum corneum* and *Gracilaria confervoides* approach omst nearly in character the algæ from which thao is made. Gélose, of which thao consists, differs from the Carrageenin obtained from *Chondrus crispus* in its power of combining with a very large quantity of water to form a jelly; it yields ten times as much jelly as an equal weight of isinglass. For purposes of food, thao jelly is not quite so pleasant as animal jelly, as it does not melt in the mouth; it also contains no nitrogen. A great advantage which it possesses is, that it is but little prone to undergo change, so much so that the jelly is sometimes imported from Singapore, under the name of *sea-weed jelly*, sweetened, flavoured, and ready for use, and may in this state be kept for years without deterioration. Of late it has been much used for the purpose of Bacteria culture, especially in warm climates.

Chemical composition.—According to Payen, Gélose in a pure state constitutes an immediate peculiar principle, insoluble in alkaline solutions of soda, potash, and ammonia, as well as in water, alcohol, ether, and dilute acids. One of its distinctive characters, which is quite peculiar, is that of dissolving slowly in a very small quantity of concentrated sulphuric or hydrochloric acid, which it colours brown, forming with one or other of them a brown compound, which gradually solidifies, and which resists washing in cold or hot water, and even in caustic alkaline solutions. This new immediate principle cannot be confounded with any other. The ultimate analysis of Gélose presents the following results:—Carbon 42·77, Hydrogen 5·775, Oxygen 51·445. As it has not yet been possible to form with it any definite combination, from which its equivalent weight or rational formula could be deduced, it must for the present be ranked among the immediate principles having oxygen exceeding the proportion necessary to form water with the hydrogen they contain. Gélose differs from animal gelatine in not precipitating tannic acid; from starch jelly, in not being rendered blue by iodine; from gum, by its insolubility in cold water, and its great gelatinising power. From the mucilage of *Chondrus crispus*, named by Pereira Carrageenin, it appears to differ chiefly in its power of combining with a great amount of water to form a jelly, which is not the case with Carrageenin.

GRACILARIA LICHENOIDES, *Grev.*

Fig —*Bentl. and Trim., t.* 306. Ceylon Moss (*Eng.*).

Hab.—Backwaters of Ceylon. The plant.

Vernacular.—Chini-ghás (*Ind. Bazars*), Agar-agar (*Ceylon*).

History, Uses, &c.—Ceylon Moss or Agar-agar has long been used in Southern India and Ceylon as a nutritive, emolient, demulcent and alterative, especially valuable in pectoral affections. It has been described by Rumphius, Gmelin, Turner, Neos, Agardh, and O'Shaughnessy. (Conf. *Pereira's Mat. Med.*, Vol. II., Pt. I., p. 13.) It grows abundantly in the large lake or backwater which extends between Putlam and Calpentyr, and is collected by the natives principally during the south-west monsoon, when it becomes separated by the agitation of the water. The moss is spread on mats and dried in the sun for two or three days, it is then washed several times in fresh water, and again exposed to the sun, which bleaches it. The following directions for using the moss are given in the *Bengal Pharmacopœia*, p. 276:—For a decoction, take 2 drachms ground to fine powder, water 1 quart, boil for 20 minutes and strain through muslin. By increasing the proportion of the ground moss to half an ounce, the filtered solution on cooling becomes a firm jelly, which, when flavoured by cinnamon or lemon peel, sugar and a little wine, is an excellent article of light food for sick children and convalescents.

Description.—Ceylon Moss is in whitish or yellowish-white ramifying filaments of several inches in length (when unbleached it is purple). At the base the largest fibres do not exceed in thickness a crowquill; the smallest fibres are about as thick as fine sewing thread. To the naked eye the filaments appear almost cylindrical and filiform; but when examined by a microscope, they appear shrivelled and wrinkled. The branchings are sometimes dichotomous, at other times irregular. The coccidia are inconspicuous when dry, but when moist are readily seen. They are hemispherical, about the size of a poppy seed, and contain a mass of minute oblong, dark-red spores. The consistence of Ceylon moss is cartilaginous. Its flavour that of sea-weed, with a feebly saline taste. (*Pereira's Mat. Med.*, Vol. II., Pt. I., p. 14.)

Microscopic structure.—Frond composed of large oblong cylindrical cells, containing granular endochrome, those of the surface forming moniliform, densely packed filaments. Fructification of two kinds—1*st*, hemispherical coccidia, containing a glomerule of oblong spores on a central placenta, within a pericarp of moniliform densely crowded filaments; 2*nd*, oblong tetraspores imbedded in cells of the surface. (*Endlicher.*)

Chemical composition.—This algal has been examined chemically, in 1834, by O'Shaughnessy; in 1842, by Guibourt; and in 1843, by Wonneberg and Kreysiig, by Bley and by Riegel. O'Shaughnessy found it to consist in 100 parts of vegetable jelly 54·5, starch 15·0, ligneous fibre (cellulose?) 18·0, mucilage 4·0, inorganic salts 7·5.

König gives the following as representing the percentage composition:—

Water	19·56
Albuminoids	2·53
Nitrogen-free extract	73·60
Ash	4·31

The authors of the *Pharmacographia* state that, “ Cold water removes the mucilage, which after due concentration may be precipitated by neutral acetate of lead. This mucilage, when boiled for some time with nitric acid, produces oxalic acid and microscopic crystals of mucic acid, beautifully seen by polarised light, soluble in boiling water and precipitating on cooling. With one part of the drug and 100 parts of boiling water, a thick liquid is obtained, which affords transparent precipitates with neutral acetate of lead or alcohol, in the same way as Carrageen. With 50 parts of water, a transparent tasteless jelly, devoid of viscosity, is produced; in common with the mucilage it furnishes mucic acid if treated with nitric acid. Micro-chemical tests do not manifest albuminous matter in this plant. Some chemists have regarded the jelly extracted by boiling water as identical with pectin, but the fact requires proof. Payen called it Gélose.” (See last Article.) Mr. H. G. Greenish has examined the carbohydrates of Ceylon Moss, and found that the gelatinizing constituent—the Gélose of Payen—is a carbohydrate convertible by boiling with dilute acid into Arabinose, and probably indentical with a similar constituent in the Agar-agar. In addition to this body (36·7 per cent.), the drug contains mucilage, starch, metarabin, wood gum, and cellulose. A carbohydrate termed Paramylan, occurring to the extent of 6·5 per cent., is also present. This substance is dissolved out by dilute acid, and differs from Pararabin in being directly convertible into sugar, and then yielding not Arabinose, but a fermentable sugar, probably grape-sugar. (*Archiv. der Pharmacie*, xvii, 241.) The inorganic salts of Ceylon Moss consist, according to O'Shaughnessy, of sulphates, phosphates and chlorides of sodium and calcium, with neither iodide nor bromide. Bley found iron, silica and iodic salt in the ash.

Commerce.—See last Article. This substance is preferred to Japanese Isinglass by the Hindus, as they suspect the latter substance to be of animal origin. Value, Rs. 12 per cwt.

LAMINARIA SACCHARINA, *Lam.*

Fig.—*Turn. Fuc., t.* 163. Sweet Tangle (*Eng.*).

Hab.—All deep Seas. The plant.

Vernacular.—Galhár-ka-patta (*Hind.*).

History, Uses, &c.—This sea-weed is a regular article of commerce coming through Cashmere to India, and is to be found in most of the bazars of the Punjab and Sind. Cayley (1867) noted its import into Leh from Yarkand, and Honigberger states that in his time the plant was officinal at Lahore and in Cashmere, and that it was stated to be obtained from a salt lake somewhere in Tibet. Murray says that it is supposed to come from the Caspian, and that it is used in Sind in the form of a syrup combined with a decoction of quince seeds for the cure of goitre, scrofula, and syphilitic affections. When dried in the sun it exudes a whitish saccharine substance.

For an interesting note on *Algin,* first isolated by Mr. Stanford from sea-weed, we would refer the reader to the *Jr. Soc. Chem. Industry* for 1885 and 1886.

DIATOMACEÆ.

Husn-i-yusuf is composed of small, hard, white bodies, which, on being magnified, are seen to be the shells of different diatoms. The drug is described in native medical works as very acrid and only to be used externally as a rubefacient. It is said to be found floating in lakes in Cashmere, and would appear to be the same as the Shuka of Sanskrit medical writers, which was rubbed in to increase venereal excitement; its use seems to have been much abused, as we find *Shukadoshanimittavyadhayah* (sores caused by Shuka) treated of as a disease by Susruta.

The Madhukosha describes Shuka thus—

शूको जलशूकः । यस्तु विषजंतुर्जलमण्डूकः स शूकः । शूकप्रधानो वात्स्यायनाद्युक्तो योगो लिंगवृद्धिकरः स शूक उच्यते । सटीकनिदानम् ।

—*Calcutta Ed.*, p. 298.

END OF THE THIRD VOLUME.

PHARMACOGRAPHIA INDICA.

INDEX

5-7256

AND

APPENDIX

TO THE

PHARMACOGRAPHIA INDICA,

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OOTACAMUND.

London:—KEGAN PAUL, TRENCH, TRUBNER & Co., Ld.
Bombay:—EDUCATION SOCIETY'S PRESS, BYCULLA.
Calcutta:—THACKER, SPINK & Co.

1893.

In issuing the Index *and* Appendix *the Authors wish to state that supplementary volumes of the* PHARMACOGRAPHIA INDICA *will be published as material becomes available.*

C. J. H. WARDEN.
DAVID HOOPER.

July, 1893.

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APPENDIX.

RANUNCULACEÆ.

On the Crystalline Alkaloid of Aconitum Napellus.*

Messrs. Wyndham R. Dunstan and W. H. Ince, Ph.D., have investigated the properties of a crystalline alkaloid obtained from the root of *Aconitum Napellus* by extraction with amyl alcohol, as suggested by the late Mr. John Williams (*Pharm. Journ.* [3], xviii., 238). For a supply of the material they are indebted to the kindness of Messrs. Howards & Sons, of Stratford.

The yellowish indistinct crystals melted at 188·4° (corr.), and by crystallization from alcoholic solution were proved to be associated with a small quantity of a gummy amorphous base. On combustion the original substance gave numbers agreeing fairly well with the formula $C^{33}H^{43}NO^{12}$, which is that proposed for aconitine by Wright and Luff (*Journ. Chem. Soc.*, 1879). The alkaloid was purified by repeated crystallization from a mixture of alcohol and ether, or more readily by conversion into its hydrobromide and regeneration of the alkaloid from this salt or by regeneration from its crystalline aurochloride. It crystallizes in tabular prisms belonging to the rhombic system; the crystallography of the substance has formed the subject of a separate inquiry by Mr. Tutton. The crystals are very slightly soluble in water and light petroleum, more soluble in ether and alcohol, most soluble in benzene and chloroform. They melt at 188·5° (corr.). Contrary to the statements of previous observers, who found aconitine to be lævo-rotatory, the authors found an alcoholic solution to be *dextro-rotatory* $[\alpha]_D + 10{\cdot}78°$; the aqueous solution of the hydrobromide is, however, lævo-rotatory $[\alpha]_D - 30{\cdot}47°$. On analysis, the pure alkaloid afforded results which agreed best with the formula $C^{33}H^{45}NO^{12}$.

Two crystalline *aurochlorides* were obtained. One ($C^{33}H^{45}NO^{12}HAuCl^4$), melts at 135·5° (corr.); the other, a basic aurochloride ($C^{33}H^{45}NO^{12}AuCl^3$), melts at 129° (corr.). These compounds are obtained without difficulty, and afford trustworthy means of identifying aconitine. The alkaloid may be readily recovered from them in a pure state.

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* The substance of a communication made to the Chemical Society, March 19, 1891.

Aconitine is not appreciably affected by heating at a temperature below its melting point, but at this temperature it is gradually converted into the uncrystallizable base aconine. Prolonged boiling in aqueous solution induces a similar change, but not to the same extent, unless an alkali is present. Boiling with water acidulated with hydrochloric acid also produces decomposition of the alkaloid.

Dehydraconitine or *apoaconitine* is a base differing from aconitine by the absence of a molecular proportion of water, which was first obtained by Wright and Luff by acting on aconitine with acids. Its existence has, however, been questioned by later workers. The authors find that such a substance may be readily procured by heating aconitine with saturated aqueous tartaric acid in closed tubes, as recommended by Wright and Luff. The crystals of this substance melt at 186·5° (corr.). It forms crystalline salts, and in other respects closely resembles the parent alkaloid. The results of analyses agree well with the formula $C^{33}H^{43}NO^{11}$. Three *aurochlorides* were obtained. One ($C^{33}H^{43}NO^{11}HAuCl^{4}$) melts at 141° (corr.). This salt, when crystallized from aqueous alcohol, becomes a hydrate—

$$(C^{33}H^{43}NO^{11}HAuCl^{4}H^{2}O),$$

melting at 129° (corr.), isomeric with aconitine aurochloride, into which, indeed, it very readily changes. The third aurochloride is a direct compound of the alkaloid with auric chloride ($C^{33}H^{43}NO^{11}AuCl^{3}$); it melts at 147·5° (corr.).

An *amorphous base* was obtained from aconitine, together with benzoic acid, by prolonged heating with water in a closed tube. It appears to be identical with the *aconine* of Wright and Luff. The same substance is formed together with a resinous substance when aconitine is heated with an alkali. Neither aconine nor its salts could be crystallized. The amorphous base, after purification, and its amorphous aurochloride, afforded analytical data agreeing respectively with the formulæ $C^{26}H^{41}NO^{11}$ and $C^{26}H^{41}NO^{11}HAuCl^{4}$.

The Alkaloids of True Aconitum Napellus.

Professor Dunstan and Mr. John C. Umney have examined the alkaloids of true *Aconitum Napellus* plants grown by Mr. E. M. Holmes, at the instance of the British Pharmaceutical Conference.

The alkaloids were extracted from the root by the following process, which precludes the possibility of the occurrence of hydrolysis, &c.:—The solution obtained by percolating with cold rectified fusel oil (b. p. 100–132°) was agitated with water acidified with 1 per cent. of sulphuric acid, and the resin having been removed by extracting the acid solution so obtained with chloroform, the liquid was made just alkaline with dilute ammonia and extracted with ether, which dissolved out a considerable quantity of alkaloid, but left in solution a further and smaller quantity, which was subsequently extracted by agitation with chloroform. The *alkaloid soluble in ether* was obtained as a gum-like mass incapable of crystallization. By conversion into bromhydride it was separated into a crystallizable and an uncrystallizable salt.

The crystalline product was identified as the salt of aconitine, the crystalline and highly toxic alkaloid already described by one of the authors and Dr. W. H. Ince (*C. S. Trans.*, 1891). The alkaloid separated from the pure bromhydride melted at 188·5° (corr.), and afforded on combustion numbers agreeing with the formula $C^{33}H^{45}NO^{12}$. The specific rotation of the bromhydride in aqueous solution was ascertained to be $[\alpha]_D$—29·65, a value which agrees with that previously recorded. As some doubt exists as to the solubility of aconitine in water, a determination was carefully made with this pure specimen. The mean of two determinations gave 1 gram in 4,431 grams of water as the solubility at 22°; Jürgens had previously recorded the far greater solubility of 1 in 745 at the same temperature.

The non-crystalline bromhydride furnished a gummy alkaloid soluble in ether and alcohol, but only sparingly soluble in water, the aqueous solution being alkaline to litmus, and very bitter, but not giving rise to the tingling sensation so characteristic of aconitine. Not only the alkaloid, but also the chlorhydride, sulphate, nitrate and aurichloride prepared from it could not be crystallized. This alkaloid is not identical either with aconine or with the picraconitine of Wright and Luff. A full account of it will be given in a later paper, considerable progress having already been made in the most difficult task of isolating it in a pure state. The authors propose to assign to it the name *napelline*, which was first given to the alkaloid now known as pseudaconitine, and afterwards by Hübschmann to a substance which the work of Wright and Luff showed to be a mixture chiefly composed of aconine. The napelline obtained in the manner described is probably associated with another amorphous alkaloid about which they have at present little information to give beyond the fact that neither it nor its salts appear to crystallize.

The *alkaloid soluble in chloroform* was proved to be *aconine*, the compound which is obtained together with benzoic acid on hydrolysing aconitine.

The roots of true *Aconitum Napellus*, therefore, must be held to contain three alkaloids, one of which is crystalline, *viz.*, aconitine, two being amorphous, *viz.*, napelline and aconine. Indications have been obtained of the presence of a fourth alkaloid, which is amorphous and closely resembles napelline.

The authors find that the juice expressed from the roots contains a large proportion of amorphous bases but very little aconitine, the greater part of this latter remaining in the root, from which it may be extracted, together with the remainder of the amorphous alkaloids, by exhausting with amyl alcohol. The total quantity of amorphous alkaloid obtained amounted to more than twice that of aconitine.

The physiological action of the alkaloids referred to is being investigated. The results so far obtained point to the conclusion that crystalline aconitine is by far the most toxic of the alkaloids contained in *Aconitum Napellus.*

The formation and properties of Aconine and its conversion into Aconitine.

Owing to the uncertainty which exists with reference to the product of the hydrolysis of aconitine, Professor W. R. Dunstan and Dr. F. W. Passmore have re-investigated the subject, using a pure alkaloid. Wright and Luff have stated that when aconitine is hydrolysed, the sole products are aconine and benzoic acid. More recently, however, Dragendorff and Jürgens have asserted that the hydrolysis occurs in two stages, their contention being that benzoic acid and an alkaloid identical with the picraconitine isolated by Wright and Luff from the roots of supposed *Aconitum Napellus* are formed in the first stage, while in the second stage the picraconitine is hydrolysed into benzoic acid, methyl alcohol, and aconine, which last is the final product of hydrolysis.

The authors have carefully hydrolysed pure aconitine by heating it with water in closed tubes at 150°, but have been unable to obtain at any stage either picraconitine or methyl alcohol. The alkaloid extracted from the solution by ether was proved to be a mixture of aconine with unaltered aconitine. Using pure aconitine, action occurs precisely in accordance with the equation $C^{33}H^{45}NO^{12} + H^2O = C^{26}H^{41}NO^{11} + C^7H^6O^2$, leaving little doubt that aconitine is benzoylaconine.

Although attempts to establish the correctness of this inference by heating aconine with benzoic anhydride were without result, anhydroaconitine was eventually obtained by the interaction of aconine and ethylic benzoate at 130°: as the anhydro-compound is convertible into aconitine, the partial synthesis of the alkaloid thus effected leaves no doubt that it is benzoylaconine.

Up to the present time, neither aconine nor its salts have been obtained in a crystalline state. The authors have hitherto been unsuccessful in all their attempts to crystallise aconine, but they have succeeded in crystallising several of its salts, *viz*, the chlorhydride, bromhydride, sulphate, and nitrate. All these salts are very soluble in water, the chlorhydride being least soluble and the easiest to crystallise: it is best prepared by crystallisation from a mixture of alcohol and ether; when dried at 100° it melts at 175·5° (corr.). The crystals deposited from alcohol have the composition $C^{26}H^{41}NO^{11},HCl,2H^2O$. When dried at 100° they still retain one molecular proportion of water, which is, however, lost at 120°. The aqueous solution is lævo-rotatory: $[\alpha]_D = -7{\cdot}71°$. It combines with auric chloride, forming an aurichloride considerably more soluble than the corresponding aconitine salt.

Aconine was prepared from the pure chlorhydride by adding silver sulphate and subsequent treatment of the aconine sulphate with exactly sufficient baryta water. The solution on evaporation furnished a hygroscopic, brittle gum which refused to crystallise; this melted at 132° (corr.), and on analysis it afforded numbers agreeing with the formula $C^{26}H^{41}NO^{11}$, which is that proposed by Dunstan and Ince from the results of their study of pure aconitine. Aconine is very soluble in water; the aqueous solution is alkaline. When dry it is insoluble in ether and almost insoluble in chloroform. It is a powerful reducing agent, precipitating the metals from solutions of gold and silver salts; it also reduces Fehling's solution. The physiological action of pure aconine is being investigated. Its aqueous solution is slightly bitter and gives rise to a burning sensation in the mouth, but does not produce the tingling which is characteristic of aconitine. In respect of its action on polarised light, aconine exhibits the same peculiarity as aconitine. Its salts are lævo-rotatory, whilst a solution of the alkaloid is dextro-rotatory, $[\alpha]_D + 23°$. When heated with alkalis, aconine slowly resinifies.

The action of various re-agents on aconine has so far not led to any important results. Nitrous acid fails to attack it. The principal product of its oxidation by alkaline permanganate is oxalic acid. Attempts to isolate an additive compound with methyl iodide have been unsuccessful.

By the action of methyl iodide on aconitine a crystalline *aconitine methiodide* ($C^{33}H^{45}NO^{12} \cdot CH^3I$) was obtained, which melts at 219° (corr.). The *aconitine methhydroxide* prepared from the compound ($C^{33}H^{45}NO^{12} \cdot CH^3OH$) is amorphous, and the salts which it yields do not appear to crystallise. A further study will be made of this compound, and its physiological action will be investigated.

Professor Dunstan, in conjunction with Messrs. Harrison and Carr, has continued his investigation of the aconite alkaloids, and the results were communicated to the Chemical Society, February 2, 1893. It was discovered that aconite root contains an amorphous alkaloid, napelline, which is isomeric with aconitine, but has a distinctly different physiological effect, and is not nearly so poisonous. In an examination of some commercial specimens of aconitine, the authors found large proportions of amorphous alkaloids present, and specimens of aconitine salts were found, in nearly every case, to be chiefly napelline salts containing small quantities of aconitine compounds.

The Aconites and Aconitines.

E. Richards and F. A. Rogers arrive at the following conclusions :—

The best material for the preparation of aconitine is the fresh root of *Aconitum Napellus.*

The alkaloid resides chiefly in the cambium layer, the fibro-vascular bundles, and the sieve ducts.

Pure aconitine crystallizes in thin, flat, hexagonal prisms with acute ends.

It is probable that two isomeric forms of aconitine exist ; for these the terms α-aconitine and β-aconitine are suggested.

The composition of aconitine corresponds to the formula $C^{33}H^{45}N^{2}O^{12}$, which contains twice as much nitrogen as the formula hitherto accepted.

The proportion of alkaloid in the root is as follows :—

		Per cent.
Aconitum Napellus, fresh	... ...	0·71
„ „ dried	... ...	0·14
Japanese aconite „	... ...	0·57

The method for the preparation of aconitine, recommended by the authors, is as follows :—

The powdered tubers are macerated from three to four days with washed fusel oil, then percolated, and the alkaloid extracted from the percolate with small quantities of dilute sulphuric acid. The fusel oil is removed from this solution by treatment with ether, and the dissolved ether driven off by heat. The alkaloid is precipitated from the acid solution by solution of sodium carbonate, collected on a strainer, pressed between limestones, and then spread on bibulous paper and allowed to dry at ordinary temperature. The dried alkaloid is then boiled with pure dry ether, and the filtrate set aside to crystallize; the crystals are redissolved in a small quantity of ether to remove a gum-like body.

The toxicity of α-aconitine is stated to be only one-sixth of that of β-aconitine. (*Chemist and Druggist*, Feb. 7, 1891, 205, and Feb. 15, 1891, 242, 243.)

Ehrenberg and Purfürst infer from their experiments with aconitine that its composition is more correctly represented by the formula $C^{32}H^{43}NO^{11}$, than by that assigned to it by Wright and Luff ($C^{33}H^{43}NO^{12}$), or Dunstan and Ince ($C^{33}H^{45}NO^{12}$). They state that by heating with water to 150° C., or by treatment with alcoholic potash, aconitine does not at once yield benzoic acid and aconine; but that, in addition to benzoic acid, methylic alcohol and another acid are produced. The authors state that by boiling aconitine with water there is at first produced a salt of a new base, which crystallizes when the liquid cools, and this product is described by them as benzoate of picraconitine. This is represented as being formed by simple hydrolysis—

$$C^{32}H^{43}NO^{11}+H^{2}O=C^{25}H^{39}NO^{10}+C^{7}H^{6}O^{2}.$$

By continuing the boiling a further alteration is effected according to the equation—

$$C^{25}H^{3}NO^{10}+H^{2}O=C^{24}H^{37}NO^{10}+CH^{3}OH.$$

Picraconitine. Napelline. Methyl alcohol.

The formation of aconine is represented as constituting a third stage of alteration as follows :—

$$C^{24}H^{37}NO^{10}+H^{2}O=C^{22}H^{35}NO^{9}+C^{2}O^{4}H^{2}.$$

Napelline. Aconine. Acetic acid.

The authors suggest that it is still doubtful whether the acid product of this final change is acetic acid or acrylic acid, and that, in the latter case, the formula of aconine would be $C^{21}H^{35}+NO^{9}$.

From the production of mehtyl alcohol in the decomposition of aconitine when heated with water, it is inferred that aconitine is analogous to cocaine, and is to be classed with the acid esters, either as an acetyl or an acryl ester of benzoyl aconine, while aconine itself would be a derivative of a trimethoxylmethyl quinone. (*Journ. f. prakt. Chem.*, xlv., 604.)

Note on Mishmee Teeta and Bee (or Poison).

These roots are procured on the range of hills inhabited by the Mishmee tribe, and annually in the cold season a large supply is brought down to the plains, and the Mahajans here, who are principally Marwar people, give in exchange for them beads, salt, coloured woollen and cotton cloths, &c., &c. The Mahajans state that these articles are readily purchased in Central and Lower Assam.

The Natives here use the Teeta as a medicine in colic, ophthalmia, headache, and fever.

The *Bee* or poison, which is brought down by the hill-tribes, is parboiled with a view to prevent its cultivation in the plains. It is generally employed by hunters for killing wild animals.

Mishmee Teeta as a remedy for Colic.—Take 20 grains of Mishmee Teeta, 10 to 12 whole grains of black pepper, about 10 grains of salt. The whole is to be masticated and washed down with a small quantity of water.

Mishmee Teeta as a remedy for Ophthalmia and Headache.—Take 2 drachms of Mishmee Teeta and grind it with sufficient water to form a paste, which is to be applied round the eye twice a day. For headache it is applied to the forehead and temples.

Mishmee Teeta as a remedy in Fever.—Take 1 drachm Mishmee Teeta finely powdered, and mix with half a pint of cold water. To be taken daily in two doses. Purgatives are never used by the hill-tribes.

Mishmee Bee (or poison) employed by hunters.—Take 2 or 3 drachms of Mishmee Bee finely ground, and mix with any acid glutinous vegetable pulp, so as to form a thick paste, which is to be applied to the head of the arrow and allowed to dry in the shade.

The glutinous substance generally used is the pulp of a sour fruit called *Owe Tangah* by the Assamese and *Chultah* in Bengali (*Dillenia Speciosa*). I imagine it is preferred in consequence of its acidity preventing a flow of blood from the wound, which would wash away the poison. (*By the Medical Officer, Chyckwah, Upper Assam, June 11th*, 1842.)

Delphinium Zalil.

Aitchison (*Notes on Products of W. Afghanistan and N.-E. Persia*, p. 55) says :—"Yellow Larkspur, *asbarg*, *aswarg*, *isbarg*, *isbarag*, *isparak*, *sparak*, *sparig*, *jalil*, *zalil*; the flowers, *gul-i-zalil*, *gul-i-jalil*. A perennial herb, with a thick short woody rootstock, from which several annual shoots spring ; these are from one to two feet in height, each usually bearing a terminal spike of exquisite yellow flowers. When the flowers are at their best, the annual shoots bearing the spike of inflorescence is broken off close to the root; these are collected together, and then laid in heaps, usually on the roofs of the houses, to dry. In two or three days they are sufficiently dry, when the twigs are shaken over a sheet ; on this all the flowers tumble off, and are collected, either for local use or exportation. The petals are of commercial importance, yielding a valuable yellow dye for silk, and are exported for this purpose in large quantities to Persia, Turkistan, Afghanistan, and India. The dye is easily obtained by simply boiling the flowers in water ; in this decoction the silk is dipped. The dried stems also yield a dye upon being boiled, but this is poor in comparison with that yielded by the flowers."

In the *Dict. Econ. Prod. of India*, iii., 70, it is stated that in Multan the flowers are used along with *Akalbér* (*Datisca cannabina*) and alum to dye silk, giving a sulphur-yellow colour known as *gandhaki*, and that they are also used in calico-printing. Their price in the Punjab is said to be Rs. 27·5 per cwt. This dye is alluded to by Mr. Leotard, Dr. McCann, and Mr. Wardle, but under the name of *D. Ajacis*.

The Hellebores of the Ancients.*

Drugs prepared from hellebore were so famous amongst the ancients as a remedy for madness, and, indeed, for many other ailments, that the plant has acquired for itself a literary as well as a botanical interest. Pliny gives a list of them quite worth the notice of advertisers of patent medicines. We know that different species have been used in different countries for their medicinal properties, which are, perhaps, essentially the same in all of them, though varying in strength. The hellebore of the modern English Pharmacopœia is the root of *Helleborus niger*, the common Christmas Rose. In Germany, *H. viridis*, the green hellebore, is said to be preferred, and from its frequent occurrence in England in the neighbourhood of old ruins, we may infer that it was formerly used here. At Constantinople a popular drug, called Zoptane, is made from *H. orientalis*, which is common on the mountains of Eastern Turkey. In Gerard's time, our native *H. fœtidus*, the rankest of all the genus, was employed medicinally, though known to require great caution in using, and it is still retained in veterinary practice for outward application.

The physicians of ancient Greece, who for some centuries before and after the Christian era were famous throughout the civilized world for their skill, were very fanciful about the locality from which the herbs used by them were collected. The kind of herb might be the same, but when gathered on a particular mountain or in a particular forest it was thought to have additional virtue. Drugs of the same name were classified as first, second, third or fourth quality, according to the source from which they came, and were priced and trusted accordingly. Hellebore was of two kinds, distinguished as black and white. The best black came from Mount Helicon, and the best white from Mount Œta. The town most famous for its preparation was called Anticyra, but this name was ambiguous.

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* From the *Gardeners' Chronicle*, January 2.

There is a well-known passage in "The Art of Poetry," written by the Roman poet Horace, in which he says, that to gain a reputation as a poet, a man must be so mad that three Anticyras cannot cure him, and must never have his hair cut. Multiplying by three was a common superlative figure of speech in Latin, as in any other languages, and perhaps Horace meant no more than this; but, on the other hand, he may have known that there were in Greece three towns named Anticyra, and possibly they were all places where the drug hellebore was prepared. One Anticyra was on a narrow strip of the land of the Locrians, between Ætolia and the sea. Strabo, an ancient writer on geography, and Livy, a Roman historian, both mention it. It was taken by the Romans in the second Punic war, and given over to their allies, the Ætolians. We know nothing of it as connected with hellebore, though Phiny tells us that Ætolian hellebore, which was of bad quality, was used to adulterate the better Parnassian kind. There was another Anticyra in the south-eastern corner of Thessaly, three or four miles from the sea, near the base of Mount Œta and the famous pass of Thermopylæ, but we do not hear of this town as producing hellebore, except on the slight authority of the lexicographer, Stephanus of Byzantium, who lived in the sixth century of our era. The third Anticyra, the only one which we know to have been famous in classical times for the manufacture of this drug, was situated on the southern coast of Phocis, not far from the base of Mount Parnassus, and within a few miles of Mount Helicon. The position of it is well known, and it is now named Aspra Spitia ; it was not an island, as Pliny and others have wrongly said, and never can have been so in historic times ; but it stood on a peninsula and had a good harbour. In Horace's day it was a place of resort for insane or epileptic patients, who went there to take a course of hellebore under resident physicians. Hence, to say, "You should go to Anticyra," was a polite way of telling a man he was a fool. Amongst others who had gone through this medical course there, Pliny mentions the philosopher Carneades, who went there for intellectual training, before publicly declaiming against the dogmas of the Stoics, apparently supposing that a medicine which could make madmen sane would make sane men still wiser. Also Drusus, a famous popular leader of the Romans, was cured there of epilepsy. The same writer adds that this drug, which retained its virtue for thirty years, and once was thought so formidable, had now become so "promiscuous" in its use that students often took a dose of it to sharpen their intellect when they were puzzled by difficult passages in their reading—a valuable hint, by the way, for candidates before a competitive examination! I recollect a virtuous freshman at Cambridge, who, with a similar object, laid in a large stock of "Reading biscuits," which he saw advertised in a window!

The next question is, what were the kinds of hellebore called black and white, and found respectively on Mount Helicon and Mount Œta? We ought to be able to answer this, because Edmond Boissier has told us, in the preface to *Flora Orientalis*, that, thanks to the labours of the botanists, Orphanides and Heldreich, the flora of Greece is now better known than that of any other country within the scope of his work. The hellebore which is found to prevail on Mount Helicon, Mount Parnassus, and the neighbouring country is one to which E. Boissier gives the name of *H. cyclophyllus*. It is intermediate between *H. viridis* and *H. orientalis*, having been confused with the latter both by Sibthorp and by Heldreich. Perhaps it is not in cultivation in England, but it is described as being taller and having larger flowers and broader segments to the leaves than the green hellebore, which in other characters it resembles.

As for the white hellebore, it is evident from the vague descriptions of Theophrastus and Pliny, that neither of them knew a living hellebore by sight, but Pliny says that he had been told that the leaf of the black hellebore was of the shape of a plane leaf, but divided into several segments, and that the white hellebore had leaves resembling those of the beet, and deeply channelled at the back. He attributes to it a bulbous root like that of an onion, with fibrous tunics. Ancient and modern botanists have generally identified this with *Veratrum album*, which is figured in Gerard's "Herbal" as the white hellebore; but perhaps the best evidence is that of Heldreich, who explored Mount Œta in 1879, and found *V. album* growing there in abundance, confirming his previous opinion that this was the white hellebore of Theophrastus. The different effects of the two kinds of hellebore taken medicinally, as recorded by ancient authorities, correspond with modern experience; the black is a powerful cathartic, and the white a strong emetic. This is a summary of all that is known or likely ever to be known of the famous hellebores of the ancients. (*C. Wolley-Dod, Pharm. Journ.*, Jan. 30, 1892.)

We have never met with any kind of hellebore root in the Indian Bazars, nor are any of the genus known to grow in India; still, all Indian Mahometan works on Materia Medica contain an account of the hellebores of the Greeks, which has been copied from the writings of the Arabian physicians, and which is mostly a reproduction of what Dioscorides says περὶ ἐλλεβόρου λευκου and περὶ ἐλλεβόρου μέλανος the *Verarum album et nigrum* of the Romans. The Arabs call these drugs *Kharbak-abiad* and *Kharbak aswad*, and in Indian medical works *Kutki* or *Kutaki* is given the vernacular equivalent of Kharbak, and this drug is sold as a substitute for it. For an account of Kutaki, see Vol. III., p. 10.

MAGNOLIACEÆ.

Constituents of Star-anise.

The determinations of volatile oil, fixed oil, and ash gave the following percentage figures:—

	Volatile Oil.	Fixed Oil.	Ash.
Carpels	6·11 5·20	1·13 1·47	2·81
Seeds	3·00 2·40	22·9 21·7	2·46

The volatile oil consists chiefly of anethol $C^6H^4(OCH^3)C^3H^5$; with small quantities of terpenes, safrol $C^6H^3(O^2CH^2)C^3H^5$, the monoethyl ether of hydroquinone $C^6H^4(OH)OC^2H^5$, anisic acid $C^6H^3(OCH^3)COOH$, and a complex aromatic substance yielding upon oxidation veratric acid and piperonal. The fixed oil contains the usual constituents along with cholesterin and derivatives of phosphoric acid. In the aqueous extract is found protocatechuic acid and shikiminic acid $C^7H^{10}O^5$, which by nascent hydrogen iodide is converted into benzoic acid. Sugar was not found in any appreciable quantity, the sweet taste of the fruit, therefore, depending upon the volatile oil. Nitrogenous bases could not be detected. (*F. Ostwald, Arch. der Pharm.*, 1891, 84—115.)

Michelia Champaca.

Merck describes a kind of camphor, called champacol, obtained from champaca wood by distillation with water. After purification it melts at 86—88°C., has the form of long white felted needles, has no odour when pure, but when kept in an impure state becomes liquid and develops the agreeable odour of the wood. (*Berichte*, 1892, p. 18.)

MENISPERMACEÆ.

Constituents of Calumba Root.

M. Bocchiola (*Chemist and Druggist*, Jan. 10, 1891) gives the following percentage composition of the cortical and woody portions of the root:—

	Outer part.	Inner part.
Water	13·00	14·00
Ash	5·00	6·00
Ether extract	0·70	0·80
Alcohol extract	3·89	3·86
Proof Spirit extract	17·96	17·80
Calumbine	1·42	1·90
Do. by titration	0·98	1·38
Berberine	1·43	0·72
Do. by titration	2·95	1·45

The percentage composition of the ash was:—

Silicic acid 14·13 and 7·42, phosphoric acid, as an iron salt, 6·11 and 1·61, phosphoric acid, combined with alkali and earthy bases, 5·04 and 12·63, in the outer and inner parts of the root.

The author found old roots to contain as much as 2·07 and 2·63 per cent. of calumbine, and 2·05 and 1·02 per cent. of berberine, showing their superiority over the younger roots.

BERBERIDEÆ.

Berberis vulgaris, *Linn.*

Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia*, p. 25) has the following notice of this plant:—"The Barberry, *jir*, *jir-khár*, *zer-khár*, *zir*, *zir-bár*, *zir-balak*; the fruit, *zirishk*, *sirishk*. A very common shrub, growing at an altitude of 2,000 feet and upwards, from which is largely collected the fruit; this is consumed locally, as well as being exported in some quantity to India, where it is highly appreciated by the natives as a condiment. Usually the fruit contains no seeds; it is then much more oval, longer, and of a much lighter colour than that which has seeds. On reaching the Punjab the fruit or preserve is called *zirishk-tursh*, to distinguish it in the trade from small, dried, black grapes; the latter are our European currants, or corinths. From the root-stocks of the

Berberis is obtained an extract called *Ibrán*; this is a yellow dye, which is also employed in medicine as a local application to inflamed eyes."

Podophyllum emodi.

We have met with the root in the plains in the possession of a pilgrim from Kedernath. He called it *Mámirán*, and greatly valued it as a remedy for ophthalmia, his small stock of four or five roots was carefully wrapped in several covers of silk.

Analysis of the Resin of Podophyllum emodi.

Ash	None.
Moisture	4·2
Oily and waxy matter, soluble in benzin	4·0
Podophyllotoxic acid	13·1
Podophyllotoxin, active principle	56·55
Inert matter insoluble in chloroform and soluble in alcohol	22·15
	100·0

The percentage of active principle, podophyllotoxin, in this sample is fully 25 per cent. higher than the average amount found in resin of podophyllum, which varies from 40 to 45 per cent. American podophyllum yields, on a large manufacturing scale, 5 per cent. of podophyllin, and accepting 10 per cent. as a practical average from the Indian, we should have a drug worth 2½ times in value. (*By F. A. Thompson, Ph. G., Am. Journ. Pharm.*, May, 1890.)

Podophyllotoxin.

This substance, which was first shown to be the active principle of Podophyllin by Podwissotzki, has now been obtained in a pure state by Neuberger (*Arch. f. exp. Path. u. Pharm.*, xxviii., H. 1, 1890); it forms colourless prismatic crystals, little soluble in water, but freely soluble in alcohol, forming an intensely bitter solution. Frogs were not easily affected by it, and it required a dose of 0·01 gram administered in mucilage to produce a muscular rigidity which was followed by death in three days; a congested state of the intestinal vessels was observed in some cases. It appeared to have little or no action upon rabbits. Cats were very susceptible to the poison, death following three days after the subcutaneous injection of 0·001 gram. In these animals, 2 to 3 hours after the injection violent and repeated vomitings occurred, at first of food, and afterwards of mucus tinged with bile, and containing some intestinal worms; there was also obstinate diarrhœa. Finally the animals became dull, the temperature fell, the limbs were paralysed, and death occurred from exhaustion. Dogs, pigeons, and fowls were similarly affected.

The *post-mortem* appearances observed were intense irritation, and sometimes abscess at the seat of the injection, the stomach normal or slightly injected, the upper portion of the mucous membrane of the duodenum highly injected, especially round the opening of biliary duct, the lower portion covered by a mass of brown epithelium mixed with detritus and mucus; the lower part of the small intestine, and the whole of the large intestine, was covered by hæmorrhagic patches, and here and there by a membranous exudation, with intense inflammation of the adenoid tissue, the sub-mucous and muscular layers not being affected. Liver congested, gall-bladder swollen and full of bile. Kidneys congested, with marked glomerulo-nephritis and commencing tubular nephritis. The distended gall-bladder and injection of the duct appearing to indicate elimination of the drug through the liver, the author tied the latter in three of the dogs experimented upon, and afterwards injected podophyllotoxin beneath the skin; the results were exactly the same as in the case of the dogs not previously so treated.

Injections of podophyllotoxin into the veins gave exactly the same results as when it was administered internally or injected subcutaneously. The circulation, respiration, and nervous system were only affected a little before the fatal termination in all the animals experimented upon.

From these experiments the author concludes that the drug acts as a simple irritant, and that its purgative action when given internally is due to irritation of the intestinal canal. When injected under the skin or into a vein, it is eliminated by the blood through the kidneys and intestine, and in its passage through these organs it sets up the irritative action already described.

Mr. J. C. Umney contributed a paper on *Podophyllum emodi* at the Pharmaceutical Conference held in Edinburgh in August 1892, from which we extract the following :—

The results of Podwissotzki's work on the resin of *P. peltatum* may be briefly summarized thus—

The physiologically active portion of podophyllum resin consists of podophyllotoxin, which is composed of picropodophyllin held in solution by picropodophyllic acid.

Picropodophyllin is a neutral crystalline principle, which, though the sole active ingredient of the resin, is inactive in its free state, owing to its insolubility, but in combination with, or more probably solution in, picropodophyllic acid is extremely active. The resin also contains an inactive acid—podophyllic acid, a yellow colouring matter,—podophylloquercetin and fatty matter.

The results of the examination of *P. emodi* resin are classified in the following table, and are compared with the analysis, under the same conditions, of a sample of resin of *P. peltatum* :—

	P. emodi.	*P. peltatum.*
Resin by official process for podophyllin resin	11·4	5·9
Constituents of the resin—		
Podophyllotoxin (crude)	17·8	33·8
Pure crystalline picropodophyllin... ...	2·6	4·5
Picropodophyllic acid	not determined.	not determined.
Podophyllic acid	30·8	6·9
Podophylloquercetin	1·3	2·4
Fatty matter	2·3	5·7

The picropodophyllin melted at 208—210°C.

The podophyllic acid melted at 125°.

The podophylloquercetin melted at 248°.

Mr. Umney concludes his paper by saying that the rhizome of *Podophyllum emodi* yields nearly double the amount of resin yielded by *P. peltatum*, but the resin contained only about half the quantity of crystalline picropodophyllin, to which the value as a cathartic is due.

We have not heard of any medical opinions concerning the value of the resin, and without such opinion founded on physiological experiments we cannot decide the question of making this drug an official source of podophyllin resin.

PAPAVERACEÆ.

The Opium Assay Question.

Perhaps no chapter of Pharmaceutical Chemistry has received more attention and been more discussed than that of opium and its analysis. Scarcely a journal appears nowadays that does not contain an article or two upon how opium can "best" be assayed and just how the method of Prof. X—— or Mr. Y—— is inaccurate and unreliable. There is a certain sameness about articles written about opium assaying—a sameness that becomes monotonous in course of time, and causes the reader to become perplexed, if not disgusted, as the result of a perusal of them. Invariably the author picks all other methods to pieces and then proposes an "original new" method which gives better agreeing results, and is much more easily manipulated than any yet proposed. As a matter of fact, we possess not a single accurate and exact method of analysis of any plant or of any of its organic constituents. Plant analysis, as *Dragendorff* aptly remarks, has not yet reached the stage which enables us to say, without an interrogation point at the end of our sentence, that this plant contains just so much of that constituent and no more. Plant analysis is as yet synonymous with approximate analysis, and until our knowledge of the chemistry and physiology of plant life and growth has advanced considerably beyond its present status, it is doomed to continue to be approximate analysis. Hence, no method is accurate, as, for instance, is the determination of sulphuric acid as barium sulphate, or of hydrochloric acid as chloride of silver, and if one of them does give better agreeing results, and such as are nearer the mean of those obtained by all other methods, this is due most probably to the fact that in this particular method the sources of error are more nearly counterbalanced than in the others. It was, hence, from a purely impartial and critical standpoint that I undertook to compare several of the most prominent methods for assaying opium.

Those decided upon were the methods of Flückiger, Squibb, and of the U. S. Pharmacopœia—being virtually the ammonia *versus* the lime method. The drugs examined were Smyrna opiums from the house of Merck and of Gehe & Co., the former having been ordered and received by myself while still at the laboratory of Gehe. Rath Fresenius at Wiesbaden during the past summer, and the latter kindly given me by my instructor, Professor Flückiger, here at the laboratory. Both samples were finely powdered and dried at 80° C. for five hours. All three methods were begun at the same time, and the directions for each closely followed throughout. In both cases the determination by the U. S. P. method was completed long ere the others were, while Squibb's method, due to its more frequent washing and slower filtering, took up the most time. Just at this point I should like to protest against the impracticability and uselessness of weighing liquids, which so often is found in methods of plant analysis and nowhere else. As I see the matter, there is not one point in its favor, unless, perhaps, that it is an inherited custom, while there are certainly many points against it. Firstly—it occupies more time; secondly—accurate balances are not arranged for weighing liquids, and inaccurate balances (or moderately accurate balances, as their owners would probably prefer to term them) certainly make the weighing less accurate than measuring; and thirdly—weighing, even on accurate balances, is seldom, if ever, more accurate than measuring with graduated glassware, which every druggist does, or, at any rate, should possess. The U. S. P. method, besides being the shorter, required less attention and care than the other methods, and, as the figures will shew, gave the most satisfactory results. As this is all that is required of a method of analysis, I can see no reason why the present officinal process should be altered, for no other now in use is more exact and at the same time as practical. The morphine obtained in every experiment with the U. S. P. method was undoubtedly the whitest and purest of all the crystals obtained by any method. There was less washing necessary than in either Squibb's or Flückiger's method, and at the same time the filters and crystals upon them were beyond any question of a doubt the purest and whitest. Here follow the figures:—

	Merck Opium.	Gehe Opium.
Flückiger	9·52 p. c.	13·95 p. c.
Squibb	11·67 p. c.	16·52 p. c.
U. S. P.	11·44 p. c.	15·00 p. c.

As these figures shew, Flückiger's method gave the lowest and Squibb's the highest results, which facts are, however, very easily explained, and as follows: In Flückiger's method the result depends very much, if not entirely, upon the amount of shaking that is done, as Dieterich has conclusively shewn, and as I only shook for about half an hour steadily, with continued shaking at intervals of ten minutes for two hours more, it is very probable that all of the morphine did not separate out. The high figures obtained by Squibb's method are undoubtedly to be explained by the impurity of the resulting products, which fact could readily be detected by the naked eye, as they were invariably very dark-coloured. Despite all the washing that they were subjected to, they never once were even approximately near being colourless, and besides invariably dissolved in lime water only in part and gave as a result a very dark-coloured solution. It was found that continued washing would not remove the impurities, for long before the crystals and filter paper shewed any signs of becoming decolourized, the wash water ran through absolutely pure and colourless. In both cases the morphine obtained by the U. S. P. method dissolved completely in lime water and gave a pure, limpid, clear solution, while that obtained by Flückiger's method, although it gave a colourless solution in lime water, *yet left* a small residue amounting to several milligrams and consisting of narcotine, as did the residue obtained in Squibb's method. This would indicate that in the presence of alcohol and water, the ether does not completely dissolve all of the narcotine.

Morphine Picrate.

Inasmuch as this salt of morphine had not yet been described, and the similar salt of strychnine is practically insoluble in water, and hence enable us to determine the alkaloid as strychnine picrate, it was made by treating a solution of morphine hydrochlorate with a slight excess of picric acid, in the hope that it, too, might prove to be insoluble, and thus facilitate somewhat the method of determining morphine. Recrystallized from alcohol it crystallizes in groups of fine yellow needles arranged most peculiarly in the shape of warts, which grow one along-side of the other, and hang from the surface of the liquid looking much like plaits of hair. The salt melts, or, better, decomposes, without detonation at 157° *C. It* differs from the corresponding salt of strychnine, however, in not being insoluble in either water or alcohol, as determinations *of its* solubility gave the following results:—

In distilled water at 13° *C.*—15·6975 grams of a saturated solution yielded 0·031 grams of morphine picrate (dried at 100°) which gives a solubility of 1 part in 500 parts of water.

In absolute alcohol at 13° *C.*—7·2422 grams of a saturated solution yielded 0·009 grams of morphine picrate (dried at 100°) which gives a solubility of 1 part in 800 parts of alcohol.

This being the case, it is, of course, impossible to make use of the salt as a means of determining morphine. (*Alfred Dohme, Ph.D., Laboratory of Prof. Flückiger, University of Strassburg*, February 17, 1891; *Am. Jour. Pharm.*, April, 1891.)

The Chemistry of Opium.

At the instigation of my esteemed instructor, Prof. Flückiger, I undertook to study the phenomena which present themselves when opium is dialyzed. When the investigation was first begun, the prime object in view was to determine, if possible, to what cause the acid reaction of aqueous extract of opium was due, and how morphine was combined in the drug. As the work progressed, it was decided to study the relative quantities of the chief constituents of the drug, and, if possible, then draw conclusions in regard to how these are combined in nature in the same. In how far this has proven successful the conclusions will shew; suffice it to say here that the work was a very long-drawn out and laborious one, and not one of the results obtained with the ease which one is accustomed to in inorganic analysis. As is the case in every operation with drugs and plants of any kind, the numerous colouring matters, gums, resins, and the many other amorphous substances of which we have but little definite knowledge, save that they exist to worry the chemist, very much hindered the work in many respects. Dialysis was chosen, inasmuch as by means of it it was hoped that all of the looked-for constituents would pass into solution, while little or none of the undesired would follow suit. Besides this, no operation was to be performed with the opium which might change the nature of combination of its various constituents. It had been observed by Flückiger that there is, in all probability, enough sulphuric acid present in opium to combine with nearly all of the alkaloids present. Whether or not, however, it is sulpuric acid or meconic acid that is in excess and hence free, as yet remained an open question. It is certainly very probable that if it were a question of which acid would first and most readily be neutralized by the bases, that sulphuric acid would be the one, although mass action might cause some of the meconic acid to be in combination at the expense of sulphuric acid. With this aim in view, 50 grams of finely powdered opium were rubbed together with distilled water and the paste washed completely into a dialyser consisting of an oval gutta-percha ring covered with heavy parchment paper and immersed in a dish containing about five litres of distilled water. This was allowed to stand covered thus for nearly three months, the water being changed about twice a week. Even at the expiration of this time, sulphuric acid and alkaloids could be detected in the dialysate, and as my time here was limited, and the semester was rapidly drawing to a close, it was decided to finish the operation more expeditiously by exhausting the opium remaining in the dialyser with cold water. This last extract was treated separately, although exactly in the same way as the greater portion. While this operation was quietly progressing, a complete analysis of the ash of opium (the same as was used for dialysis) was made in order thus to get a definite idea of the mineral constituents of the drug. Accordingly, 20 grams of finely powdered opium were carefully and gradually ignited in portions in a platinum dish. It was found very difficult to completely incinerate the drug, so that even after heating the dish to a bright red heat the resulting ash was quite dark, in fact nearly black. It was found very advantageous at this point to treat the mass with a little cold water and evaporate this off on a water-bath, and finally, again carefully heat and glow it over a free flame. By repeating this operation several times, an ash was obtained, which was very nearly pure white in colour. When weighed, it yielded 3·89 per cent. of the original substance.

A complete analysis, the details of which it would be useless to enumerate here, gave the following results, these being expressed in per cent. of the ash weighed:—

	Per cent.
SiO^2	11·14
P^2O^5	8·07
SO^3	28·39
Fe^2O^3	1·98
CaO	9·04
MgO	8·31
K^2O	30·19
CO^2, HCl and undetermined constituents	2·88
	100·00

The dialysate was next evaporated down in portions to about two litres upon a water-bath, and the resulting deposit, consisting of colouring and other organic matter, as well as some calcium meconate, removed by filtration. The filtrate reacted acid to litmus, and in it were detected morphine, narcotine, narceine, codeine, sulphuric, and meconic acids. It was next acidified with hydrochloric acid, and after heating on the water-bath was treated with a boiling solution of barium chloride in excess. After standing over night the resulting barium sulphate was filtered off and washed out with hot water containing hydrochloric acid until it was white. It was then dried, ignited, and weighed, and yielded, with the portion that was similarly treated separately, the following figures :—

Portion I—$BaSO^4$	2·9236 grams.
Portion II— „	0·3920 „
Total... =	3·3156

$$\text{Equivalent to} \begin{Bmatrix} 1{\cdot}3945 \text{ grams } H^2SO^4, \\ \text{or } 1{\cdot}1384 \quad „ \quad SO^3 \end{Bmatrix}$$

The filtrate from this precipitate was neutralized and precipitated in the cold with ammonia which was added in slight excess. After standing for several days, the precipitated alkaloids were filtered off and the filtrate again made ammoniacal and left to stand, when more alkaloid was precipitated. This was continued until the resulting filtrate no longer gave a reaction for alkaloids. The various precipitates were then filtered off and dried at 80° C. to constant weight, and regarded as the total alkaloids of the opium taken. They were then treated for several days with an excess of lime-water until this took up no more alkaloid. The remaining alkaloids were then filtered off, washed with slightly ammoniacal cold water, and dried at 80° C. They were then weighed and regarded as narcotine. The results obtained are given below—

Porcelain dish + alkaloids (total)	= 24·3023 gr.
„ „ alone	= 14·0465 gr.
Hence, total alkaloids found	= 10·2558 gr.
Narcotine (weighed on tared filter)	= 4·3631

giving as the final result—

Morphine, 5·8927 grams, equivalent to 11·79 per cent.
Narcotine, 4·3631 „ „ to 8·73 „ „

The other alkaloids present in opium, such as codeine, narceine, papaverine, &c., were not considered separately, as they, in all probability, play the same *rôle* with respect to the acids present as does morphine.

In a separate experiment with the same opium, which was dialysed in the same manner as that just described, the dialysate was shaken with amyl alcohol, the latter then separated and shaken in a separating funnel with a solution of sodium hydroxide for half an hour, and the alkaline layer separated as before. This was then acidified, and a few drops of it, when brought in contact with a drop of a solution of ferric chloride, gave a beautiful wine-red colour, thus shewing the presence of meconic acid. Inasmuch as experiments with morphine and narcotine meconates had shewn that neither of these are taken up by amyl alcohol, it follows that the free acid in the dialysate was meconic acid.

CONCLUSIONS.

(i) That the free acid in aqueous opium extracts is meconic acid;

(ii) That the silica in opium is present in the form of sand, and that the lime is most likely combined with phosphoric acid, while the magnesia and potash are probably combined with organic acids and some sulphuric acid;

(iii) That there is more than enough sulphuric acid present in opium to combine with all of the alkaloids present save narcotine; for the 5·8927 grams of morphine, narceine, codeine, &c., found, require only 1·0133 grams of sulphuric acid to form the salts $(C^{17}H^{19}NO^{3})^{2}\ H^{2}SO^{4}$, &c., whereas there were found in all 1·3945 grams of sulphuric acid; and

(iv) That hence, morphine, narceine, codeine, &c., are contained in opium combined with sulphuric acid as sulphates, while narcotine, at best only a feeble base, is combined in part, at least, with meconic acid, of which there is also some present uncombined in the drug.

In conclusion, I should like to take this occasion to thank Prof. Flückiger for the kind assistance and advice I obtained from him while working in his laboratory, and also Mr. J. E. Gerock, his excellent and kind assistant. (*A. Dohme, Am. Jour. Pharm.*, April, 1891.)

Protopine.

The name of *protopine* was given to a particular alkaloid first isolated from opium in 1870 by Hesse. It is only present to a small amount in the dried milky juice of the *Papaver somniferum*. Since its discovery by Hesse, it has been met with again by Eykmann in the *Macleya cordata*, and by Selle in the juice of the

Chelidonium majus : all of these plants belong to the same family of *Papaveraceæ*. In connection with this subject we read in a recent number of the *Therapeutic Gazette* that Dr. Engel has lately made some experiments on cold-blooded animals (frogs) and warm-blooded animals (guinea-pigs, cats, and rabbits), with the view of determining the physiological properties of this new base protopine. The results obtained may be briefly summarised as follows:—(1) In small doses protopine exercises on the frog narcotic effects similar to those produced by other opium alkaloids. (2) In large doses it produces a paralysing action on the muscular substance, and on the terminal ramifications of the peripheral nerves. (3) With small or moderate doses reflex action is not abolished, although this occurs when larger doses are given. (4) Protopine produces toxic effects in mammals, and these effects are comparable to those produced by camphor, death resulting from the paralysis of the respiratory centre. This last conclusion is very interesting. It is singular that camphor, which has not the chemical constitution of the alkaloids, and belongs to an entirely different group of bodies, should have been found to produce the same toxic effects as are obtained with new base protopine. The knowledge of this fact will cause camphor to be prescribed with more care than formerly, and it will probably lead to more useful applications of it, and to its employment in a number of cases for which it is not yet used. Protopine has not yet been introduced into therapeutics, and from the above experiments it is evident we must know more about it before it can find its place in pharmacy.

Tritopine—a new Opium Base.

M. Kander (*Archiv.*, ccxxviii., p. 419) reports the isolation of a new opium alkaloid, *Tritopine*, which occurs in smaller quantity than even protopine, and to which he assigns the formula $C^{42}H^{54}N^{2}O^{7}$. Like morphine and laudanine it is soluble in soda solution, but is reprecipitated in an oily condition by excess of the reagent. Its melting point, 182° C., is, however, 16° higher than that of laudanine, although the resemblance is again apparent in its behaviour towards sulphuric acid. Tritopine crystallizes without water of crystallization in characteristic transparent needle-like plates, and appears to be a di-acid base. (*Pharm. Journ.* [3], xxi., 247.)

Indian Opium.

In regard to opium, it has recently been suggested that India might be made the source of supply in place of Turkey. In a paper read at the Conference Meeting at Cardiff, Mr. E. M. Holmes expressed the opinion that there is no reason why India, instead of Turkey, should not supply the whole world with medicinal opium. This assumption appears to be rather premature and scarcely to be warranted by such knowledge as we possess of Indian opium. There seem to be several questions to be solved before the substitution of Indian for Turkey opium can be looked upon as feasible.

In the first place, it is necessary to ascertain whether opium can be produced in India of a quality equal to that of Turkey opium. Dr. Warden's statement that native opium is used for medicinal purposes in India does not sufficiently settle that point, but as he has sent over a sample of the Patna opium issued by the Medical Store Department of Bengal for medicinal use, we have examined it with a view to ascertaining the amount of morphine it contains and its applicability for pharmaceutical purposes.

The sample sent by Dr. Warden was in the state of powder, and as received it contained 3·2 per cent. of moisture. In the dried opium the amount of morphine was found to be 8·55 per cent.

A tincture was made with the dried opium, according to the directions of the British Pharmacopœia, and on examination it was found to yield on evaporation to dryness a residue of extract amounting to 21·3 grains per fluid ounce. The amount of morphine contained in the tincture was 2·74 grains per fluid ounce.

For the sake of comparison, another tincture was prepared with a good sample of Turkey opium that was found to contain, in the dry state, 10·84 per cent. of morphine. The extract yielded by this tincture on evaporation amounted to 19·8 grains per fluid ounce. The amount of morphine in it was 3·4 grains per fluid ounce.

It may be pointed out that in both the abovementioned instances the extraction of morphine from the opium in making the tinctures by the method of the British Pharmacopœia was practically complete, as will be seen from the following comparison of the quantities of morphine actually found by experiment:—

	Found. Grs. per fld. oz.	Calculated. Grs. per fld. oz.
Indian opium tincture	2·74	2·80
Turkey " "	3·40	3·55

Both these tinctures were of the ordinary character, and there was scarcely any perceptible difference in their appearance. (Dr. B. H. Paul and A. J. Cownley in *Pharm Journ.*, December 24th, 1892, p. 505.) For further information on the employment of Indian opium for medicinal purposes, the reader is referred to some correspondence in the *Pharm. Journ.* for 1892 by Messrs. Holmes and Warden.

FUMARIACEÆ.

Fumarine.

According to Herr Reichwald (*Pharm. Zeit. f. Russl.*, March and April, 1889), fumarine has a composition represented by the formula $C^{21}H^{19}NO^{4}$, and can be obtained in colourless crystals, freely soluble in chloroform, less soluble in benzol, still less soluble in alcohol and ether, and sparingly soluble in water. When placed upon the tongue, fumarine is tasteless, but a solution in acidulated water has a bitter taste. It is inactive towards polarized light. On the other hand, crystalline corydaline, prepared from *Corydalis cava*, has a composition represented by the formula $C^{20}H^{19}NO^{2}$. Among other points of difference between the two alkaloids, fumarine is described as giving with concentrated sulphuric acid immediately an intense violet colour, whilst corydaline remains colourless for several hours, and then only becomes pale violet. Corydaline treated with strong nitric acid takes at once an intense golden-yellow colour, whilst fumarine is only faintly yellow, becoming darker after a time. The yield of fumarine was only equal to 0·04 per cent. of the dried herb used. (*Pharm. Journ.*, June 8th, 1889.)

Fumaria parviflora, *Lamk.*

Under the name of *Shahtereh*, we have received this plant from Afghanistan.

CRUCIFERÆ.

Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia*, p. 194) records the collection of the seeds of *Sisymbrium Sophia*, Linn., for medicinal use under the name of *Khakshi* or *Khakshir.*

Lepidium sativum.

Mohideen Sheriff has used these seeds with success in dysentery and dysenteric diarrhœa. The seeds are small, red or reddish-brown; elliptical, oval or oblong; about one line in length and half of that in thickness; taste mucilaginous and slightly pungent when chewed and swallowed, and their smell is slight, peculiar, and not unpleasant. When immersed in water, the seeds become coated with mucilage.

CAPPARIDEÆ.

Mærua arenaria, *H. f. and T.*

Fig.—*Roxb. Flor. Ind. ii.*, 570.

Hab.—Central and Southern India. The root.

Vernacular.—Poomichacarei (*Tam.*), Puta-tiga (*Tel.*).

History, Uses, &c.—The earth-sugar root of the Tamils has been used in Hindu medicine in Southern India for many years. In the *Pedatasintharmine*, the author says of it: "It cures skin eruptions, all venereal affections, fever, piles, and strengthens the human system." Dr. Ainslie, in his *Materia Indica*, ii., page 330, says: "This root in external appearance is not unlike liquorice root; it also somewhat resembles it in taste, but is not nearly so sweet; it is prescribed, in decoction, as an alterative and diet drink." The drug is used by Mahomedans and Hindus as a sexual stimulant and tonic, anti-syphilitic, and alterative. It can be used either in a fresh or dried state. The outer brown covering is supposed to be harmful, and is removed previous to use. Dr. P. S. Mootoosawmy, of Tanjore, has used the root in his medical practice, and on his forwarding a flowering and fruiting specimen of the plant to Mr. Lawson, of the Madras Botanical Department, it was identified as *Mærua arenaria.* Roxburgh describes the plant under the name of *Capparis heteroclita*, R., and remarks that the unripe fruits are boiled and eaten by the natives.

Description.—*Mærua arenaria* is a large, unarmed, climbing shrub; leaves elliptic; corymbs terminal; calyx four-cleft; corolla regular, four-petalled; stamina on the receptacle, which is as long as the tube of the calyx. The most remarkable part of the plant is the fruit; this is a beaked berry, two to five inches long, deeply constricted between the seeds, fleshy, elongate, moniliform, one or more seeded. There is only one seed in each single berry or lobe of the compound fruit.

The roots are plump when fresh, from 1 to 1½ inches in diameter, long, cylindrical, contorted, with a light brown surface. When dried they become darker in colour and wrinkled longitudinally, and several irregularly-disposed transverse markings of a lighter colour are observed on the surface. The transverse section of the root exhibits a central hard woody centre of a yellowish colour, and several similar but smaller bundles are scattered throughout the waxy-looking parenchyma of the cortical portion. In the bazars the drug is sold in the shape of circular discs like calumba root, having been sliced transversely in a fresh state and allowed to dry in the sun. Sections of the root examined by the microscope exhibited no starch or crystalline matters in the cells, but yellow granular matter and oil globules were present. The central woody column and woody bundles in the cortical portion were made up of large lignified cells. The taste is sweet and mawkish, and there is no distinctive odour as there is in liquorice root.

Chemical composition.—The finely powdered root lost 11·26 per cent. of moisture, and left 6·6 per cent. of mineral matter when ignited. The ether extract amounted to 4·22 per cent., and consisted of fatty acids of a brownish colour and fluid consistence. After standing a few days, white crystals formed, which were collected and pressed between folds of blotting paper, and recrystallised from boiling alcohol. This insoluble portion had the melting point (62° C. and properties of palmitic acid. Oleic acid was present in the fluid portion of the extract.

The alcoholic extract contained a large quantity of crystalline saccharine matter, which reduced Fehling's solution to a very slight extent. A small quantity of an organic acid was removed from solution by plumbic acetate, but no substance similar to glycyrrhizin could be detected. The absence of an alkaloidal principle was proved after the application of the usual reagents.

The aqueous extract contained an additional quantity of sugar, and when heated to the boiling point threw out an abundance of white flocks of albumin. A larger quantity of the root was exhausted directly with water, the extract heated to separate the insoluble albumin, and filtered. The syrup was then boiled in an inverted condenser with 1 per cent. sulphuric acid for three hours. The sulphuric acid was removed with barium hydrate solution, and the sugar in the syrup estimated with Fehling's test indicated the presence of 41·2 per cent. of invert sugar. This sugar showed no disposition to crystallise, and when examined in a Laurent's polariscope, it had no action on polarised light.

CARYOPHYLLEÆ.

False Bikh or Bikhma.

Towards the end of 1891 certain medico-legal exhibits were received in the Chemical Examiner's Department, Calcutta, from the Mongyr District, including a parcel of roots labelled *Bikhma.* Bickhma or Bishma, we may mention, is the vernacular name for *Aconitum palmatum.* Specimens were sent for identification to the Calcutta Bazaars, and recognized as Bikhma; we also forwarded some to Nepal, where it was recognized, and stated to be sold as Bikhma in the Bazaars. Up to this period we had had no opportunity of examining authentic specimens of Bikhma, and being doubtful whether the drug we had received from Mongyr was true Bikhma or not, we forwarded a sample to Dr. Dymock, Bombay, who reported as follows:—"They appear to be the rhizomes of an aroid, and are not unlike those of the genera Lagenandra, Arum, and Cryptocoryne. They have been cured by some smoking process, have a strong tarry odour, and are somewhat translucent, tough, and flexible. They have no resemblance in structure to any kind of aconite. I have never seen them before." Dr. D. Prain, of the Royal Botanic Gardens, Seebpore, to whom we also submitted a specimen, wrote: "I cannot identify it for certain, but it is, I think, a leguminous rhizome. It might be a glycyrrhiza." Subsequently Dr. Dymock kindly sent us a specimen of true *A. palmatum*: "some of the same batch I sent to Flückiger, and which was examined by Shimoyama. I kept it as being a remarkably fine sample; as the drug is expensive, it may be adulterated with aconite. Rs. 6 per lb. is the price, and aconite is only 9 annas." His sample, when compared with ours, was wholly dissimilar. Under the circumstances we thought it might be of interest to examine the spurious Bikhma, and our results are embodied in this note. In the condition in which the roots were received they were so horny that it was impossible to powder them, and they were cut into fragments, exposed to a temperature of about 80° C. for some time, allowed to cool, and then at once pulverised. During the process the dust caused watering of the eyes and sneezing. When dried at 100° C. the powder lost 6·23 per cent. of moisture. In extracting the powder 315·5 grammes were exhausted with boiling rectified spirit, and the tincture evaporated on a water-bath until it ceased to smell of alcohol. The resulting extract was of a dark brown colour and of the consistence of treacle. The marc left after extraction with boiling spirit was repercolated with 250 c.c. cold spirit containing 1 per cent. of tartaric acid, and the spirit evaporated off at a low temperature. The two extracts were now mixed with water containing 2·5 grammes of tartaric acid, and the mixture agitated with light petroleum ether. During agitation a few yellowish flocks separated. The petroleum ether extract amounted to 1·173 per cent., calculated on the root containing 6·23 per cent. of moisture. The petroleum ether extract was yellowish-brown in colour, semi solid in consistence, and waxy in odour. The taste was nauseous, recalling croton oil. In absolute alcohol it was wholly soluble with strongly acid reaction. On spontaneous evaporation of the alcoholic solution, a yellow transparent mass was left at the bottom of the beaker, while on the sides the deposit was yellowish-white and opaque. On microscopic examination, it appeared as minute needle-shaped crystals. An attempt was made to separate the petroleum ether extract into fractions, and with this object it was gently warmed with proof spirit, which dissolved a certain amount, and the extract was thus roughly divided into a soluble and insoluble residue. The proof spirit solution, on spontaneous evaporation, deposited soft orange resinous matter, while some white deposit separated on the sides of the capsule. This was found to consist of oil globules, and a few minute needle-shaped crystals. In addition to oil and resinous matter possessing an acid reaction, the presence was also detected of an alkaloidal principle soluble in ether, which afforded marked indications with the usual reagents. With Fröhde's reagent no change was observed in the cold, but a dirty blue developed on gently warming. The portion of the petroleum ether extract insoluble in proof spirit was boiled with alcoholic potash, the solution evaporated to dryness and treated with water. The aqueous solution was turbid from the separation of brown flocks. The turbid solution was agitated with petroleum ether. The ethereal extract had a camphoraceous and terebinthinate odour, was of an orange colour, and had a melting point of 62° C. It was not further examined. The aqueous soap solution was decomposed by dilute sulphuric acid and agitated with ether. The ether extract was converted into a lead soap and reagitated with ether. The soluble lead soap, after separation of lead, afforded a residue which was liquid at ordinary temperatures and of a reddish-brown colour. When agitated with a freshly prepared solution of nitrate of mercury, it solidified to a yellowish mass. The insoluble lead soap, after separation of lead, afforded a residue which was solid at ordinary temperatures, and had a melting point of 48°. Neither of these fatty extracts was pure, and no attempt was made to ascertain whether they consisted of single acids or mixtures. The presence of glycerine was determined in the original aqueous sulphuric acid solution. The aqueous acid solution of the alcoholic extract of the roots, after treatment with petroleum ether, was agitated with ether. The ethereal solution was allowed to evaporate spontaneously, and the final desiccation conducted over sulphuric acid. The non-crystalline residue was dark brown and tacky with tar-like odour; it amounted to ·123 per cent., calculated on the roots containing 6·23 per cent. of moisture. Warmed with distilled water, a part of the extract dissolved, the solution affording the following reaction:—

Reaction, strongly acid.
Fe^2Cl^6 gave a dirty greenish coloration, passing rapidly to dirty brownish.
$AgNO^3$, slight turbidity; on warming Ag. reduced.
Aqueous NH^3, orange yellow coloration.
Acetate of lead, dirty yellowish, white ppt.
Gelatine, no precipitate.
KCN., no reaction.

That portion of the ether extract insoluble in warm water was treated with aqueous NaHO, and the dark brown solution which resulted agitated with ether. The ether solution exhibited slight fluorescence, and on spontaneous evaporation afforded a yellow crystalline deposit, which appeared as needles and rosettes on microscopic examination. By treating this residue with proof spirit a certain amount of neutral resinous matter of a yellow colour was separated. This was precipitated on dilution with water. The insoluble crystalline residue afforded no crystalline sublimate when heated between watch glasses. The aqueous soda solution of the ether extract was mixed with dilute sulphuric acid and reagitated with ether. The ethereal extract was of a yellowish-brown colour, strongly acid in reaction, and had the properties of an acid resin.

The tartaric acid solution of the alcoholic extract of the drug was now mixed with a very slight excess of sodium bicarbonate and again agitated with ether. After agitation and on subsequent standing, a small quantity of a white crystalline substance separated, which floated on the water stratum below the ether. The ether was separated and allowed to evaporate spontaneously, the extract amounte to ·048 per cent.; it formed a yellow transparent varnish on the sides of the capsule, while at the bottom it was white, chalky, and indistinctly crystalline; odour, aromatic. The chalky deposit consisted of some irregularly-shaped plates and amorphous particles. The yellow varnish-like residue was easily soluble in proof spirit, but neither this portion nor the chalky deposit afforded any reaction with alkaloidal reagents. The chalky deposit treated with concentrated H^2SO^4 afforded a yellow solution in the cold, changing to pinkish on standing for some time, but on heating the pink colour was developed rapidly. Nitric acid, no reaction. Fröhde's reagent, greenish in the cold, passing to blue on warming. Ferric chloride, no reaction Heated with dilute aqueous H^2SO^4 and the solution neutralised it reduced an alkaline copper solution on boiling. When agitated with water, considerable frothing was noted. A small amount injected, mixed with water, into a cat's stomach induced no symptoms When applied to a cat's eye, there was no change in the size of the pupil observed. The yellow varnish-like deposit separated from the chalky deposit, by the action of proof spirit, when injected into a cat's stomach caused the animal to vomit once a small quantity of frothing liquid; one formed stool was also passed, but no other symptoms were noted. The varnish-like residue, when applied to the tip of the tongue, produced a slight sensation of tingling or numbness, which lasted for a short period, and could not be mistaken for the symptoms induced by aconitine.

The alkaline aqueous solution of the alcoholic extract was next agitated with chloroform. The extractive was yellowish-brown, with an odour like that of gum benzoin, and amounted to ·064 per cent. In *cold* proof spirit it was partly soluble, the solution on spontaneous evaporation affording a residue which contained a few microscopic plates. The residue insoluble in cold proof spirit was pale yellow and soluble in boiling proof spirit. On spontaneous evaporation a white crystalline deposit was obtained, consisting of bundles of rods and a few plates. The residue frothed when agitated with water, and when treated with concentrated sulphuric acid yielded a rose coloration. The alkaline aqueous solution of the alcoholic extract was finally agitated with amylic alcohol. The extract amounted to 1·582 per cent., and formed a transparent, soft, viscid residue of a reddish-yellow colour, non-crystalline, and frothing considerably with water. In warm water it dissolved, forming a clear solution, which became turbid on cooling. An attempt was made to decolourise the aqueous solution by agitation with purified animal charcoal, but very little colouring matter was thus removed. As neutral salts, as NaCl, $MgSO^4$, gave a white curdy precipitate from the aqueous solution of the extract, an attempt was made to separate the saponin-like principle by saturating the watery solution with $MgSO^4$; it was found, however, that the flocks agglutinated together, forming a sticky mass, and filtration was impossible. Baryta water was next used for separating the principle. With this object the amylic alcohol extract was dissolved in water and excess of aqueous barium hydrate added. The turbid mixture was then filtered (filtrate A), the precipitate was washed with baryta water and transferred to a beaker, water added, and CO^2 passed for a considerable time. The turbid mixture was then evaporated to dryness on a water-bath, and exhausted with rectified spirit, the filtered alcoholic solution was evaporated to dryness, and left a scaly, friable, shining residue, which afforded the following reactions:—With concentrated H^2SO^4 a yellow coloration, changing to red. Concentrated HNO^3, yellow. In concentrated HCl it dissolved freely, forming a faint pinkish coloured solution, the colour deepening on the application of heat, and a few flocks separating. In strong acetic acid it was also readily soluble, forming a colourless solution, no change being induced by the subsequent addition of potassic dichromate. When heated with aqueous phosphoric acid it did not yield a clear solution, no colour developed, and no odour. With aqueous ammonia it was sparingly soluble; no precipitate with acetic acid; the ammoniacal solution frothed on agitation. Boiled with dilute HCl, it afforded a solution which reduced alkaline copper. The amount of principle precipitated by baryta was small, and though this principle afforded some of the reactions of saponin, it seemed probable that the greater part was still present in the filtrate.

A fresh portion of the original amylic alcohol extract was dissolved in water, and treated with lead acetate, which afforded a white curdy precipitate, after separation of lead by H^2S, yielded extracts which frothed strongly on agitation with water, and gave some of the reactions of saponin. The amount of extractive yielded was, however, small, and it appeared to us that probably both the lead precipitates were either unstable compounds of a saponin with that metal, from which the greater part of the principle could be separated by washing, or that they consisted chiefly of easily soluble lead salts of a saponin, or of a lead salt of a saponin mechanically mixed with a saponin precipitated by the action of lead acetate, in the same manner as we have found certain neutral salts to act. But, on the other hand, it was possible, assuming the existence of more than one saponin-like principle in the plant, that one saponin formed a stable and insoluble lead compound, the other an unstable or soluble salt. And similar remarks might also apply to the barium hydrate precipitate.

As bearing on these points the following experiments were made:—The amylic alcohol extract was dissolved in water, excess of lead acetate added, and the turbid mixture repeatedly agitated with amylic alcohol. During agitation the greater part of the precipitate agglutinated, forming a yellow viscid coating on the bottom and sides of the bottle. This deposit appeared to be very slightly soluble in amylic alcohol. It was soluble in acetic acid, and the acid solution, when agitated with amylic alcohol, afforded an extract which frothed with water, and yielded certain of the reactions of saponin. The viscid deposit from which this extract was obtained would therefore appear to represent a saponin, which formed a stable lead compound, only slightly soluble in amylic alcohol. The original amylic alcohol solution was next examined to ascertain if it contained any saponin-like principle or not. It was first filtered, and then evaporated to dryness on the water-bath. The residue was yellowish and brittle, and contained a small quantity of lead. The amount of extract was far larger than that obtained from the viscid deposit after decomposition with acetic acid. Lead was removed by dissolving the extract in water and passing H^2S. The filtered solution was then evaporated to dryness, the residue reduced to fine powder and repeatedly agitated with ether, which removed some colouring matter and traces of amylic alcohol. The resulting powder was white and free from odour. It afforded the following reactions:—With cold water it formed a slightly opalescent solution, which frothed considerably on agitation. Concentrated H^2SO^4 at first faint yellow, changing to pink, carmine, with violet at the edges on standing, and green on the addition of potassic dichromate. Concentrated HNO^3 colourless, yellow on the addition of dichromate, and changing to blue on standing for some time. In concentrated acetic acid, readily soluble, forming a colourless solution. Soluble in dilute ammonia, forming a solution which frothed, and from which acetic acid gave a white precipitate on neutralisation. Caustic soda, similar reactions to ammonia. Tannic acid, a white precipitate. Ferric chloride, a turbidity in the cold, which disappeared on heating, the solution being of a brown colour. On boiling with dilute HCl, dark brown, oily globules separated, and the solution reduced alkaline copper. This decomposition product did not appear to possess the properties of the principle described as *sapogenin*, obtained by the action of dilute acids on ordinary saponin. The ash amounted to ·47 per cent.; it was free from lead.

To determine the ultimate composition of this saponin, it was dried over sulphuric acid in a vacuum, and the combustion made in an open tube in a current of oxygen, and the results afforded the following percentages:—

	Exp. 1.	Exp. 2.	Mean.
Carbon	60·92	61·18	61·05
Hydrogen ...	8·93	8·74	8·84
Oxygen... ...	30·15	30·08	30·11
	100·00	100·00	100·00

From these percentages a formula $C^{32}H^{54}O^{12}$ was deduced—

	Calculated for $C^{32}H^{54}O^{12}$.	Found.
Carbon	60·95	61·05
Hydrogen	8·57	8·84
Oxygen	30·48	30·11
	100·00	100·00

In another experiment a somewhat different mode of extracting the saponin was adopted. An alcoholic extract was obtained from another sample of *Bikhma*, no acid being used in the extraction. The alcoholic extract was mixed with water and directly extracted with amylic alcohol, without previous treatment with petroleum ether, ether, and chloroform. The amylic alcohol containing the crude saponin was separated, filtered, and then repeatedly agitated with aqueous basic lead acetate. During agitation the yellow viscid matter, already mentioned, separated on the sides of the bottle. The agitation with basic lead was continued for a considerable time, until colouring matter ceased to be dissolved. The amylic alcohol was then allowed to stand for some days, filtered, and evaporated on a water-bath. The extract was next taken up with water, and lead removed by H^2S. After filtration the solution was again evaporated to dryness, the extract reduced to powder, and repeatedly agitated and digested with ether. The saponin extracted in this manner had a faintly yellowish colour, and contained 6 per cent. of ash free from lead. After drying over sulphuric acid *in vacuo*, the following results were obtained on ultimate analysis:—

	Exp. 1.	Exp. 2.	Mean.
Carbon	60·12	60·21	60·165
Hydrogen	8·35	8·54	8·445
Oxygen	31·53	31·25	31·390
	100·00	100·00	100·000

Some of the saponin used for the last analysis was subjected to a further process of purification. It was dissolved in amylic alcohol, and the solution repeatedly agitated with aqueous barium hydrate. On evaporating the amylic alcohol solution to dryness, and heating the powdered extract with ether to separate traces of amylic alcohol, the saponin was left as a white powder which contained ·308 per cent. of ash. On ultimate analysis, the following percentages were obtained, the saponin being dried *in vacuo* over sulphuric acid:—

	Exp. 1.	Exp. 2.	Mean.
Carbon	59·90	59·82	59·86
Hydrogen... ...	8·64	8·62	8·63
Oxygen	31·46	31·56	31·51
	100·00	100·00	100·00

It seems likely to us that the last sample of saponin isolated was the purest of the three examined, though we are not prepared to definitely assert it was a *pure* saponin. We have adduced some evidence which tends to indicate that at least two saponins exist in false Bikhma, and it is possible that the method we used for separation afforded a mixture. It was our intention to have determined the ultimate composition of the saponin in combination with lead, to which we have referred as a "viscid yellow compound," and to have examined the product yielded by the hydrolysis of the saponin, but we were unable to complete our research.

The results of the proximate analysis of the false Bikhma may be stated thus:—

Moisture	6·23
Petroleum ether extract... ...	1·173
Acid ether extract	·123
Alkaline ether extract	·048
Chloroform extract	·061
Amylic alcohol extract	1·58

We also append the results of an analysis of the specimen of *A. palmatum* referred to above. Our 100 parts afforded the following results when examined by Dragendorff's method:—

Petroleum ether extract... ...	·040
Ether extract	·048
Absolute alcohol extract... ...	·150
Water extract	2·40

An alcoholic extract affords the following percentages:—

Petroleum ether extract	·946
Acid ether extract	·310
Alkaline ether extract	·371
Amylic alcohol extract	·976

The compositions of these extracts we were also unable to examine.

We may summarise our results by stating that the most important constituents of false Bikhma are saponin, and as bearing on the identification of the plant which yields the drug, we would refer to Aitchison's "Notes on Products of Afghanistan and Persia," in which it is stated that the name *Bekh* is technically applied to the root-stocks of *Acanthophyllum macrodon* and *Gypsophila paniculata.* These are both used as soaps, and possibly false Bikhma may be derived from one of these plants. (*C. J. H. Warden and Assistant Surgeon Chuni Lal Bose in "Pharm. Journ.," October* 15*th*, 1892, *p.* 302.)

PORTULACEÆ.

Chemical Composition of Portulaca oleracea.

Water	92·61
Nitrogenous substances	2·24
Fat	0·40
Non-nitrogenous extractive	2·16
Cellulose	1·03
Ash	1·56
In dry substance—	
Nitrogen	4·85
Carbohydrates	29·23

(*König*, *Nahrungs Mittel*, p. 147.)

TAMARISCINEÆ.

Remarks on the substance called Gez or Manna found in Persia and Armenia.

At entertainments in Persia a sweetmeat called *Gezangabeen* is usually met with, the pleasant taste and other singular properties of which, as well as the mystery that involved its origin, excited my curiosity to know if it were an animal or a vegetable production.

The principal ingredient in its composition is a white gummy substance called *Gez*, which, when mixed up with rose-water, flour and pistachio nuts into flat round cakes that are generally made three inches in diameter and a quarter of an inch thick, has much the appearance and feel of common dough, though a little more hard. It is at the same time both adhesive and brittle, for any attempt to cut it shows the former quality, as it sticks to the knife; and if pulled, it admits of being drawn out to some length like birdlime. The mode, however, generally practised of breaking it for use is by placing one cake on the palm of the hand somewhat hollowed and striking it with the other, when the blow occasions it to fly into several pieces, whose edges, rather unexpectedly, appear smooth and polished like broken glass.

Collection.—Before daylight we marched from Khonsar, and, on clearing the boundaries of the town, deviated from the main road as we had been directed, and began rambling amongst the bushes on the face of the mountain on our right, diligently looking for the *gez*. The directions we had received were to examine the bushes closely, as the object of our search was not easily visible at any distance; too much confidence, however, in the knowledge of our servants and guide who, with true Persian effrontery, asserted they were familiar with the appearance of the *gez.* in its natural state, nearly occasioned us a complete disappointment. We had relinquished the pursuit in very ill-humour, to resume our journey, when we met, as chance would have it, two peasants proceeding to the spot we had just quitted: as usual, we accosted them, and were not a little pleased at hearing they were the people whose occupation it was to gather the *gez*. These men were furnished with a stick three-fourths of an inch in diameter and curved at the further extremity, which was covered with leather, and a kind of oval leathern bowl, near three feet long and two broad, with a handle to it, resembling an egg-shell cut in two longitudinally. Besides these, they had a sieve suspended from the right side, to free the *gez* from the insects and small pieces of leaf that generally fall with it when first beat from the bush: the bottom of the sieve was of coarse woollen cloth.

The countrymen were easily persuaded by a trifling present to fall immediately to work and show us a specimen of their employment. They turned off the road a few yards amongst the bushes we had just quitted, and placing the leathern receptacle underneath, they beat the bushes on the top with the crooked stick; in a few minutes they had obtained a handful of a white kind of sticky substance not unlike hoar frost, of a very rich sweet taste: this, after being purified by boiling, is mixed up into the sweetmeat before mentioned under the name of *gezangabeen*.

Though the *gez*, when fresh gathered from the *gavan* bush, admits of being sifted, still in this original state it is brittle and adhesive at the same time, qualities for which it is so remarkable after its preparation as a sweetmeat. If pressed, it sticks to the fingers; but on being smartly struck with a bit of wood separates easily into small grains like lump-sugar. It is in this state in cool weather, or when the thermometer does not exceed 68° F.; but liquefies on being exposed to a higher temperature, resembling white honey both in colour and taste.

The shrub on which the *gez* was found is called the *gavan*; it grows from a small root to the height of about two feet and a half, spreading into a circular form at the top from three to four feet and a half in circumference. Captain Stewart, the gentleman with whom I was travelling, remarked that it had a striking resemblance to the broom, but it did not, we were informed, bear a yellow flower. The leaves were small and narrow, and underneath we saw the *gez* spread all over the tender branches like white uneven threads, with innumerable little insects creeping slowly about.

These little creatures appeared to derive their subsistence from the leaves and young bark of the bush they inhabit; and this is the opinion of the country people. They are either three distinct species of insects, or one in three different stages of existence: one kind is perfectly red, and so diminutive as to be scarcely perceptible; the second, dark and very like a common louse, though not so large; and the third, exactly like a very small fly. They are extremely dull and sluggish, and are found lying or creeping about between the bark of the *gavan* and the *gez*. The peasants, as well as the inhabitants of Khonsar, were decidedly of opinion that this curious substance is the production of these minute animals, as neither the insect nor the *gez* are found on any other tree in the neighbourhood; nor can we be allowed to imagine it may be a vegetable gum, as no appearance of any gummy liquid oozing from fissures in the bark of the bush could be observed on the closest examination. The people who are engaged in the collection of this curious article continue their occupation every third day for twenty-eight days during September. A journey, which I subsequently made to Baghdad, convinced me that the *gez* is not exclusively confined to this district, but is found in the range of mountains running through Koordistan, dividing Persia from Asia Minor and Mesopotamia, where it is called manna by the Armenians, and said to be exported in quantities through Erzeroom to Constantinople. (*By Captain B. Frederick, from the* "*Transactions of the Literary Society of Bombay,*" *September* 28*th*, 1813.)

Note.—The *gavan* is *Tamarix gallica*, var. *mannifera*, Ehrenb., and the aphis, which feeds upon it and produces the *gez*, is the *Coccus manniparus* of Ehrenberg. The name Gezangabeen is loosely applied by the Persians to the true manna obtained from *Cotoneaster nummularia* in Korasan, the correct name of which is *Shirkhisht*.

TERNSTRŒMIACEÆ.

Camellia theifera, *Griff.*

Tea seeds contain 35 per cent. of a somewhat thinly fluid, tasteless, inodorous oil, of a straw to amber colour, which resembles olive oil. At 15° C. it has a sp. gr. of ·9270; at 38° C. it forms an emulsion and solidifies only below—5° C. It is scarcely soluble in spirit of wine, and very sparingly in ether. Chemically, it consists of 25 parts stearin and 75 parts of olein. In China it is used as a table and lamp oil and for the manufacture of soap, for which it is specially well adapted, yielding a beautiful hard soap.

Tea oil has been used in China for a very long time, but has been only recently introduced into commerce. *C. oleifera* and *C. drupifera* yield oil for household purposes similar to the above. (*Brannt.*)

Caffeine and Theine: their identity, and the reactions of Caffeine with Auric Chloride.

In consequence of the conclusions of Mays (*Journ. Physiol.*, 7, 458: *Therapeutic Gazette*, 1866, 587), and more recently of Lauder-Brunton and Cash (*Proc. Roy. Soc.*, 42, 283; *Journ. Physiol.*, 9, 112), that the physiological action of theine obtained from tea differs in certain respects from that of caffeine obtained from coffee, the authors have searched for evidence of isomerism in these bases, the existence of which is not put beyond doubt by the chemical comparison of them which has hitherto been made.

Having extracted theine from tea and caffeine from coffee, it is shown that the two substances exactly resemble each other, and melt at precisely the same temperature, *viz.*, 234°·5 (corr.). From each base the crystalline *aurochloride* ($C^8H^{10}N^4O^2$, HCl, $Au\,Cl^3 2\,H^2{\cdot}O$) was prepared, and these two salts both melted at 242°·5 (corr.). When dried at 100°, they both lost the equivalent of two molecular proportions of water, and the anhydrous salts melted at the same temperature, *viz.*, 248°·5 (corr.). The analytical data corresponded with the formulæ given above. The complete correspondence in the properties and composition of the aurochloride is satisfactory evidence of the absence of a structural difference in the bases. In order to further confirm the identity of the two substances, a specimen of each was converted into the mercuric chloride compound ($C^8H^{10}N^4O^2$, $HgCl^2$), a stable crystalline salt. Both preparations were found to melt at the same temperature, *viz.*, 246° (corr.), and to exactly correspond with each other in other respects.

The complete identity of caffeine and theine having thus been demonstrated, the observed differences in their physiological action must be ascribed either to impurities in the specimens used, or to variations in the animals employed in the experiments. The circumstance that theine was found to be more active than caffeine, and to be capable of producing effects not produced by caffeine, tends to support the view that the theine was impure. It is now well known that tea contains other bases than caffeine, the presence of traces of which might be sufficient to account for the observed differences.

During the preparation of the pure aurochlorides for a comparison of their properties the authors obtained two new and interesting auric derivatives of caffeine.

When an aqueous solution of caffeine aurochloride is heated, a yellow, flocculent precipitate is gradually formed, which is insoluble in alcohol, chloroform, and ether, but dissolves in hydrochloric acid, reproducing the aurochloride. The substance dried at 100° forms a pale yellow amorphous powder, which melts at 207° (corr.). Analysis proved it to be aurochlor caffeine $C^8H^9(AuCl^2)N^4O^2$, a substance in which one atom of hydrogen in caffeine is replaced by the group ($AuCl^2$). It is pointed out that the ready formation of this remarkable compound from caffeine aurochloride by the loss of two molecular proportions of hydrochloric acid—$C^8H^{10}N^4O^2$, HCl, $AuCl^3 = 2\,HCl + C^8H^9\,(AuCl^2)\,N^4O^2$—is better shown by Medicus's formula for caffeine, than by that proposed by Emil Fischer, since in Medicus's formula the CH group which loses hydrogen is represented as contiguous to the doubly-linked nitrogen atom, to which the auric-chloride is attached.

By the reaction of an alcoholic solution of potassium chloraurate (KCl, $AuCl^3$) with a solution of caffeine in chloroform, a salt, crystallizing in the dark red needles, was obtained. This is shown to be caffeine potassium aurochloride ($C^8H^{10}N^4O^2$, KCl, $AuCl^3$) which differs from caffeine aurochloride in containing potassium in the place of the hydrogen of hydrochloric acid. This salt melts at 208° (corr.). It readily dissolves in alcohol and water, forming yellow solutions which appear not to contain the salt itself, but its constituents, caffeine and potassium chloraurate. The salt is nearly insoluble in ether and chloroform, but prolonged contact with these liquids leads to its decomposition into caffeine and potassium choloraurate (*W. R. Dunstan and W. F. J. Shepheard, from the Research Laboratory of the Pharmaceutical Society—The substance of a communication made to the Chemical Society, December 15th,* 1892.)

MALVACEÆ.

Althæa lavateræflora, *DC.*

Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia*, p. 9) notices it as a cultivated plant usually grown on the ridges between fields. It is grown not only for the showiness of its flowers, but for the petals, which are collected as they fall off the plant, and employed in local medicine or exported under the names of *gul-i-khatmi* or *gul-khairu*. The seeds are also collected and sold as *tukm-i-khairu*, and the roots as *reshai-khatmi*. We have received the flowers from Afghanistan, where they are used as a substitute for those of *A. officinalis*; they are very mucilaginous.

STERCULIACEÆ.

Heritiera littoralis, *Dryand.*, *Rheede, Hort. Mal. vi.*, *t.* 21.

The seeds of this plant, common on the coast, have been substituted for white Kola nuts, to which, when the chestnut coloured, papery, episperm has been removed, they bear some resemblance, but are a little larger and nearly orbicular, with a somewhat sinuous instead of an angular outline. Heritiera seeds are from 0·010 m. to 0·015 m. thick, and have a diameter of about 0·04 m.; they are concave on one side and convex on the other, and are composed of two cotyledons, one of which is double the size of the other. Heckel and Schlagdenhauffen (*Nouv. Remèdes*, 1887, p. 155) give the following as the composition of the almond:—

Oil	4·366
Tannin and colouring matter	4·983
Sugar	5·738
Sodium chloride	0·288
Cellulose and starch	55·987
Albuminoids	13·537
Lignin	12·367
Fixed salts	2·645
Loss	0·089

The ash contained traces of iron and manganese, and consisted chiefly of phosphates and sulphates of lime, potash, and soda. No caffeine was found. The seeds are eaten in India, and it is evident from the analysis that they have considerable alimentary value.

Sterculia alata, *Roxb. Bedd. Fl. Sylv., t.* 230.

The kernels contain 45·27 per cent. of a bland oil possessing some siccative properties. Eighteen kernels were eaten by one of us without any symptoms being induced, hence Roxburgh's statement that the seeds under the name of *Toolā* are said to be eaten by natives in Silhet as a cheap substitute for opium is probably based on incorrect information. The tree is one of the largest found in Bengal, and seeds very freely; in our opinion the kernels form a most excellent substitute for ordinary almonds, which they resemble in shape and size. Theobromine and caffeine were specially looked for with negative results.

Sterculia scaphigera, *Wall.*

These remarkable fruits are brought to India by Mahomedan merchants from Java and Singapore by way of Karaikal and Nagore, seaport towns on the Coromandel Coast. They are called Oomas-Mungoo in the Malay language, and are used as a demulcent drink.

Sterculia Gum.

Mr. J. H. Maiden, in an article on Sterculia gum (*Pharm. Journ.* [3], xx., 381), shows in the following table how suitable it is as a substitute for Tragacanth :—

	Sterculia.	Tragacanth.
In cold water ...	*a.* Colourless .. *b.* Granular jelly ... *c.* Adhesiveness absent or very small.	*a.* Opalescent. *b.* Smooth viscid mass. *c.* Adhesive.
Boiling in dilute alkali.	Insoluble	Almost entirely dissolves.
Caustic soda and warming.	No change of colour.	Canary-yellow colour, which fades on cooling.
Boiling in dilute acid.	Soluble, forming arabin (*J. H. M.*).	Soluble, forming pectin (*Giraud*).
Alcohol added to quid formed in (10).	Whitish precipitate (*see* fuller statement).	Formation of floating glairy mass.

He found Sterculia gum to yield to cold water only 3·14 per cent., consisting chiefly of Arabin; 75·1 per cent. of the gum was found to be Pararabin. The gum contained 16·6 per cent. water, and yielded 5·83 per cent. ash.

Mr. Maiden draws attention to the fact that Pararabin is the chief constituent of the vegetable jellies known as Agar-agar, a Ceylon moss, both of which are used by the natives of India as an article of diet like Sterculia gum, and are supposed to be very strengthening.

A sample of gum said to be from *Cochlospermum gossypium* was found by him to be similar to that of Sterculia, but as it had pieces of lace bark attached to it, it was probably Sterculia gum.

LINEÆ.

Linamarin.

A. Jorissen and E. Hairs (*Acad. roy. de Belgique* (3) 21 (1891), 529) have isolated a glucoside, linamarin, from the germs of *Linum usitatissimum*. The germs, coarsely powdered, were treated repeatedly with boiling 94 per cent. alcohol, the latter recovered and the residue taken up with warm water. The resin and fat are separated, and the aqueous solution treated with a slight excess of lead acetate. After filtration and precipitating the lead with H^2S the liquid is evaporated to a syrupy consistency. This residue is extracted with boiling alcohol, the solvent recovered for the greatest part, and the remaining liquid mixed with ten times its volume of ether under constant agitation. The residue remaining on distilling off the ether is taken up with water and this solution concentrated. Standing over sulphuric acid for some time, the concentrated solution is converted into a crystalline mass of linamarin. For purification it is again treated with ether and alcohol as above. Lastly, the principle is dissolved in two parts of warm absolute alcohol, and the solution cooled under agitation. The germs yield about 1·5 per cent. of the glucoside, which forms colourless needles possessing a refreshing but very bitter taste, is soluble in water and alcohol, but almost insoluble in ether. Concentrated sulphuric acid does not colour it; dilute mineral acids decompose the glucoside into hydrocyanic acid, a fermentable sugar reducing Fehling's test, and a volatile compound possessing some characters of ketones, and giving with iodine and potassium hydrate the iodoform reaction. Boiling barium hydrate liberates ammonia. Linamarin contains C 47·88 per cent., H 6·68 per cent., N 5·55 per cent., O 39·89 per cent. (*Am. Journ. Pharm.*, Dec. 1891.)

Growth of the Indian Linseed Trade.

Dr. G. Watt (*Dict. Econ. Prod. India*, Vol. V., p. 76) shows that the trade has expanded from about 3 cwts. in 1832 to 8,461,374 cwts. in 1888-89.

Erythroxylon Coca grown in India.*

Several samples of *Erythroxylon Coca* leaves, grown in various districts in India, have been examined by Warden; the mode of culture, altitude, and meteorological characters of the district, the kind of soil and manuring, and the methods of curing being taken into consideration. The alkaloid was estimated by Squibb's modified method: the dry pulverized leaves were moistened with alcohol acidified with sulphuric acid, percolated with alcohol, the percolate mixed with acidified water, and extracted with ether, then rendered alkaline with sodium carbonate, and again extracted with ether. This extract was washed twice with water, dried and weighed; the amounts of "crude alkaloid" so determined are given in the following table:—

District where grown.	Moisture.	Per cent. dry leaves.	
		Ash.	Crude akldaloid.
Ranchi, young leaves	6·18	6·71	1·139
„ mature leaves	8·22	8·99	0·883
Arcuttipore, Cachar	6·08	7·39	1·369
„ „	6·72	6·36	1·671
Darjeeling	10·37	7·58	1·115
Alipore, Calcutta	10·42	10·23	0·358
Matelli	9·30	12·18	1·022
Chulsa, Dooars	5·71	7·62	0·610
Jaunpore	10·05	12·64	0·571

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* *Chem. News*, lviii., 249-251, 260-262, 273-276; *Journ., Chem. Soc.*, March, 1889.

The crude alkaloid was very faintly yellow, and in no case showed any tendency to crystallization, although attempts were made to induce crystallization by extracting at various temperatures, and without applying heat, and by employing different acids and solvents. The allakoid obtained is, nevertheless, quite similar to cocaine from other sources in its physiological action, except that it seems to be more active. It dissolves readily in hydrochloric acid, and yields a soluble and insoluble platinochloride, the former containing 18·75, the latter 18·88 per cent. of platinum; discrepancies from the theoretical are assumed to be due to a variable quantity of cocamine (*Hesse, Am. Journ. Pharm.*, 1887, p. 455) in the alkaloid from Indian leaves. Both platinum salts yielded bases producing marked anæsthetic effects on the tongue; Howard has observed that the insoluble platinochloride obtained from other leaves was devoid of this property (*Pharm. Journ. and Trans.*, July 23, 1887). In one instance, stellate crystals of the base from the soluble platinum salt were obtained. Applying Williams' method, the crude alkaloid showed 2·89 per cent. of impurity, but the precipitates were not crystalline. It is noted that after the addition of ether to the acidified alcoholic solution, larger deposits of the sulphur-yellow cocatannic acid were obtained from those samples containing the highest percentages of alkaloids; it is hence suggested that possibly cocaine exists in the leaves as cocatannate.

Methods of cultivating the plants are described: the leaves are first gathered 1½ years after transplanting, subsequently whenever they are sufficiently mature; and, although the method of curing does not appear to affect the quality or quantity of the alkaloid obtained, nevertheless it is best, taking into consideration Paul's experience, to dry them, soon after gathering, at as low a temperature as possible, and when dry and cold to pack them closely in air-tight chests, as they are very hygroscopic. The quantity of alkaloid produced increases with the age of the plants (which attain a height of from 2 to 6 feet) up to 10 years, and after 20 years a slight falling off is observed, although they are in their prime even when 35 or 40 years old.

From the above results, obtained from plants and leaves of various ages, it would seem that, in India, neither altitude nor rainfall have much influence on the proportion of alkaloid in the leaves. The ash, in all cases except one, was white, the exception being an ash of a reddish hue from mature Ranchi leaves. A partial examination of some of the ash showed that they contained the following percentages :—

Samples from	Soluble constituents.	K cal. as KHO.
Darjeeling	44·42	29·26
Alipore, Calcutta	34·60	19·13
Arcuttipore, Cachar	59·02	29·84
Matelli	64·17	31·36

So that both nitrogenous and potash manures will probably be required in the future to keep up the yield from the same plantation.

Fruit of Erythroxylon Coca.

The fresh ripe fruit weighed, on an average, ·158 gram each ; they were bright scarlet in colour, and possessed a distinctly sweetish taste, but though masticated at various times, no physiolgical action on the mucous membrane of the mouth was observed. Dried in vacuo over sulphuric acid, the original tint was only slightly deepened, and this method of desiccation was employed in preparing the fruit for analysis.

Microscopically described, the fruit from without inwards presents first a single row of brick-shaped cells forming the epidermis ; within them is a single row of very large cells containing a mass of starch granules and scarlet colouring matter. Next comes the pulp, composed of parenchymatous cells, containing starch and granular matter. Then the shell, composed of an outer layer of stony cells, like bone cells, which are of considerable length ; within this layer is a row of scalariform vessels, and then several rows of pitted vessels. Then the almond, the cells of which are full of starch.

The petroleum ether extract was a deep reddish semi-solid residue, which, on microscopic examination, was found to contain lamellæ and needles of a claret colour. It contained no alkaloid, and melted at 34—35° C. A portion was saponified with alcoholic potash, and when cold agitated with ether. At 189—191° this extract melted to a clear yellow liquid, which cooled to a brittle transparent mass. Heated between watch-glasses for several days, a white sublimate was obtained, but the amount was far too small to admit of a melting point determination, or the application of other tests, in order to establish the identity of this compound with phytosterin or analogous cholesterin-like principles. The fatty acids melted at 53—54°.

The powdered fruits were then exhausted with ether, which dissolved out an alkaloid, having a slight numbing sensation on the tongue, and appearing to be cocaine.

Absolute alcohol then removed cocatannic acid and an alkaloid; and finally water extracted colouring and albuminous matters, and something which reduced alkaline copper solution on boiling.

The percentage composition of the fruit as deduced from the examination may be arranged as follows:—

Moisture lost at 100° C. after partial desiccation over sulphuric acid...	5·423
Ash...	4·271
Petroleum ether extract containing 3·021 per cent. of glycerides of fatty acids, and 1·519 per cent. of impure phytosterin (?) with colouring matter...	4·540
Ether extract, soluble in petroleum ether ·232 per cent., soluble in water and containing cocaine ·11 per cent., soluble in absolute alcohol ·069 per cent., soluble in ether but insoluble in petroleum ether, alcohol or water ·029 per cent.	·440
Absolute alcohol extract containing cocatannic acid and a trace of alkaloid...	3·820
Aqueous extract...	23·440

(*C. J. H. Warden, Pharm. Journ.*, July 5th, 1890.)

RUTACEÆ.

Oil of Lemon.

V. Olivieri (*Gazz. Chim.*, xvi., 318) found in oil of lemon, besides the limonene (Wallach), also another terpene $C^{10}H^{16}$, boiling at 170—170·5° C. (338—339° F.), the tetrabromide of which fuses at 31° C. (88°F.), but the dihydro-chloride showing the characteristics of limonene. From the higher boiling portions the author has furthermore isolated a sesquiterpene $C^{15}H^{24}$, boiling at 240—242° C. (464—468° F.), which increases in quantity with the age of the oil. For detecting adulteration with turpentine, the author recommends the use of the polarimeter. Lemon oil is lævogyre

$(\alpha)_D = -55^\circ$, while oils of turpentine are more or less dextrogyre. (French oil of turpentine is lævogyre.) (*Am. Journ. Pharm.*, Dec. 1891.

Neroli oil.

In order to be able to submit neroli oil to a closer examination, Messrs. Schimmel obtained in the spring of last year, from the Riviera, a large quantity of the flowers of the bitter orange. The blossoms were consigned preserved in diluted sea-water, and were received in good condition with the full odour of fresh flowers. From the equivalent of 560 kilos of fresh flowers, there was obtained by a process of cohobation 0·460 gram of pure neroli oil, which in many respects differed from the best French distillates met with in commerce. It had a specific gravity of 0·887, and was optically inactive. Already at a temperature of + 11° C., it showed an abundant separation of a solid body in fine shining scales. At 0° the oil solidified to a mass of the consistence of butter. The stearoptene of neroli oil, like the stearoptene of rose oil, appears to be a paraffin-like body; it can be separated from the liquid portion of the oil by the addition of 90 per cent. alcohol, in which it is difficultly soluble. The specific gravity of eleven samples of commercial neroli oil obtained from the best sources varied between 0·875 and 0·886 at 15° C. Of nine oils, one was optically active, whilst the others were all dextrorotatory, the rotation varying between + 0°52′ and + 9°40′. Only one solidified at 0° C., the others remained liquid and did not show any separation of stearoptene upon the addition of 90 per cent. alcohol. The cause of these differences between Messrs. Schimmel's distillate and commercial samples is not explicable without further investigation.

Ægle Marmelos.

The extract from the flower, called in English Marmel water, and known in Sinhalese as "Pinidiya," is used by the natives as scent one festive occasions. It is also sometimes added in the preparation of, sweetmeats for flavouring them. During the flowering season, boys and men in the villages surrounding Colombo may be seen plucking the flowers and bringing them in baskets to the town for sale, wher they are readily bought for distillation. An infusion of the flower is also used as a cooling drink. (*H. D. Lewis in "Trop. Agric.,"* Sept. 1889, p. 218.)

SIMARUBEÆ.

Quassine.

Oliveri and Denaro give the following mode of preparation of quassine (*Gaz. Chim. Ital.*, No. XIV.): Infuse for six hours 10 kilograms of powdered quassia with 45 liters of boiling water, taking care to retain the heat. Decant the liquid and make a second infusion. Unite the liquors and evaporate to 10 liters, filter and precipitate with q. s. of tannin. Place this impure tannate of quassine upon a filter, wash carefully, dilute with water, treat with carbonate of lead, and dry in a water-bath. Treat the tannate of lead and quassine two or three times with boiling alcohol, and distil the united liquors. The residue deposits crystals of quassine mixed with resinous matter. Purify by repeated crystallizations in alcohol and water. Thirty kilograms of quassia give 10 grams of pure crystallized quassine. Evaporations should be made slowly and alkaline reactions should be avoided.

BURSERACEÆ.

Chemistry of Myrrh.

Dr. Oscar Köhler publishes the results of a chemical examination of Myrrh from Sumali (*Archiv.*, June 2, 1891, p. 291): Ash 2·79 per cent., portion soluble in water 57 to 59 per cent., consisting of a gum, $C^6H^{10}O^5$. The portion soluble in alcohol was a mixture of resins. The greater portion was an indifferent soft resin (C) soluble in ether, $C^{26}H^{32}O^9$. Two bibasic acid resins, one (A) $C^{13}H^{16}O^8$, and the other (B) $C^{26}H^{32}O^9$. The essential oil 7 to 8 per cent.; the principal constituent corresponds to the formula $C^{10}H^{14}O$. If the formula for A resin be doubled, all three formulæ will contain 26 atoms of carbon, and the resins differ in the amount of oxygen they contain—

Indifferent resin C = $C^{26}H^{31}O^2\ (OH)^3$.
Resin acid B = $C^{26}H^{32}O^9$.
Resin acid A = $C^{26}H^{32}O^{16}$.

MELIACEÆ.

Naregamiaalata.

Naregamia has been physiologically investigated by Dr. Stefan Schœngut of Vienna. He used it in 24 cases, namely, one of dysentery one of pleurisy, two of pneumonia, four of emphysema, five of bronchitis, five of heart failure, and seven of tuberculosis of the lungs in different stages. One to three grammes of the tincture were given daily in doses of 3/10 to 6/10 of a gramme. Dr. Schœngut found the tincture to act as an emetic in doses of 1 to 2 grammes. No styptic or other action on the digestive organs was observed, and no benefit was derived from it in the case of dysentery. He says: "Further experiments in this direction were suspended, and the application of the remedy was confined to diseases of the air passages. In such cases Naregamia has proved to be an excellent expectorant, and especially in cases where, with a limited amount of secretion in the bronchi, a disposition existed to extreme coughing, but where there was the presence of a tough and tenacious sputum which embarrassed the elimination of this undesirable factor. In one case of bronchial catarrh, which from time to time betrayed asthmatic symptoms, Naregamia rendered great service. In a number of cases of heart difficulty, comprising two of fatty degeneration of the heart in which catarrh of the air passages existed, Naregamia proved itself very serviceable. In the case of one patient with fatty heart, after several days' use of Naregamia the objective symptoms of catarrh disappeared, the rasping diminished materially, and although the quantity of the sputum at first increased, it finally almost ceased.

Dr. Schœngut also states that the tincture of Naregamia has a decidedly beneficial action in cases of pulmonary emphysema, and that it seemed to aid the expectoration in pneumonia during the period of re-solution where the râles were prominent and frequent. In the case of patients affected with dyspnœa, he found that the breathing became less difficult under its influence, but the effects seemed to be due to an increased freedom of expectoration and the consequent removal of accumulated secretions from the lungs, an opinion which agrees with the results of experiments on animals by Prof. von Basch, showing that it has no direct action on the respiratory centres.

No special influence on the circulation has been observed under the influence of Naregamia, only a short and irregular increase of pressure being noted after large doses reaching up to 5 grammes.

Naregamia does not exert any perceptible effect upon the digestive organs, and no toxic properties reside in the remedy.

SAPINDACEÆ.

Sapindus Honey.

(*Letter to the Honorary Secretary, Bombay Natural History Society.*)

I am sending you a box of dead bees I picked up under a tree now in flower in the gardens, *Sapindus emarginatus*. The tree begins to flower about the middle of October, and bears a profusion of small, whitish, inodorous blossoms which attract the bees. It seems very strange that insects possessing such a wonderful instinct should drink the nectar from the flower and get killed in this way, for I found them dead in thousands under the tree. The effect produced appears to be that of a powerful purgative, and there are now numbers of bees buzzing about on the ground unable to fly. (*Thos. H. Storey, Oodeypore, December*, 1890.)

The bees sent were *Apis indica*. It appears from this letter that the nectar in the flowers of the Soap-nut tree contains *saponin*, the active principle of the plant. The fact here recorded has not escaped the attention of the Hindus, as Sanskrit writers mention a plant or flower growing in Malwa which they call Bhramara-mari, Bhringamari, or Bhramarari, *i.e.*, "bee-killing."

Schleichera trijuga, *Willd.*

The seed-oil of this tree, which is known in the Sunda Islands under the name "Macassar oil," and enjoys a great reputation as a hair dressing and means of removing scurf and eczema, has been submitted to examination by Messrs. Thümmel and Kwasnic (*Pharm. Zeit.*, May 20, p. 314). It was found that the seeds, which contained no starch grains, yielded to petroleum ether 68 per cent. of fixed oil, but from the seeds freed from epidermis only 45·8 per cent. was obtained by pressure. The oil was in both cases of the consistence of butter, yellow, mild in taste, and with an odour of bitter almonds. It melted at 21° to 22° C., but after long standing the more solid glycerides separated, melting first at 28° and appearing under the microscope as fine needles. The fatty acids, with the exception of 3·14 per cent. of free oleic acid, were present as glycerides. Of those in combination 70 per cent. consisted of oleic acid, and of the solid fatty acids 5 per cent. was palmitic acid and 25 per cent. arachic acid, the characteristic acid of the groundnut. Lauric acid was not present, and of the volatile fat acids only acetic acid and no butyric acid could be detected. Hydrocyanic acid was found in the oil and in the seeds, being determined as 0·03 per cent. in the former and 0·62 per cent. in the latter. No amygdalin could be detected in the seeds, but hydrocyanic acid, benzaldehyde and grape sugar, possibly the decomposition products of it, were found. A small quantity of cane-sugar was also separated in the crystallized form (*Pharm. Journ.*, May 30th, 1891).

Saponin.

The varying statements made by different authors in respect to saponin have induced Dr. Hesse to attempt to ascertain whether the substances described in recent years under that name are identical; and, if so, by what empirical formula saponin would be best represented (*Annalen*, cclxi., 371). The first question he answers in the affirmative, having arrived at the conclusion that pure saponin from quillaia bark is identical with that obtained from various caryophyllaceous plants, and with senegin. As to the second, Dr. Hesse favours the formula $C^{32}H^{52}O^{17}$, assuming the correctness of the formula attributed by Rochleder to sapogenol, the decomposition product, together with three molecules of glucose, of saponin, and that the reaction goes on in the normal way, one molecule of water being taken up for each molecule of glucose split off. The successive decompositions effected by acids may then be represented as follows:—

$$2\,C^{32}H^{52}O^{17} + 6\,H^2O = 2\,C^{14}H^{22}O^2 + 6\,C^6H^{12}O^6.$$

Saponin. Sapogenol.

$$2\,C^{32}H^{52}O^{17} + 5\,H^2O = C^{31}H^{54}O^9 + 5\,C^6H^{12}O^6.$$

Sapogenin.

$$2\,C^{32}H^{52}O^{17} + 5\,H^2O = C^{40}H^{66}O^{15} + 4\,C^6H^{12}O^6.$$

Saponetin.

$$2\,C^{32}H^{52}O^{17} + 4\,H^2O = 2\,C^{20}H^{32}O^7 + 4\,C^6H^{12}O^6.$$

Saporetin.

(*Pharm. Journ.*, May 2nd, 1891.)

R. Kobert considers that there are a series of saponins of the general formula $C^nH^{2n-8}O^{10}$, several of which are known. Saponins of the same formula and of the same chemical properties appear to have different physiological characteristics, and show great differences in their poisonous action. The sapotoxin of the *Agrostemma Githargo* (corn cockle), one of these substances, is absorbed both by subcutaneous tissues and by the intestinal canal, and thus acts as a dangerous poison. It is recommended that, before using this seed as food, the shell and embryo should be separated. (*Chem. Centr.*, 1891, ii., 176.)

ANACARDIACEÆ.

Mango Kernels.

Hindu doctors consider the kernels of the unripe Mango fruit to be very astringent, much more so than the kernels of the ripe fruits. Mohideen Sheriff and P. S. Mootoosawmy speak highly of the powdered kernels as a remedy for diarrhœa in place of chalk powder. In times of scarcity the boiled seeds have been used by the natives as a food. An analysis is here given of the kernels of unripe and ripe Mango fruits:—

	Unripe.	Ripe.
Fat...	14·28	14·75
Tannin	8·97	8·45
Sugar and Gum	4·90	6·00
Ash	1·98	2·32
Moisture	11·22	11·28
Residue	58·65	57·20
	100·00	100·00

The residue consisted mostly of starch. The fat, after washing with alcohol, melted at 34° and became solid again at 30°. (*D.H.*)

Anacardic Acid as Hair Dye.

The pigmentary properties of the viscous liquid secreted under the pericarp of the cashew-nut (*Anacardium occidentale*) has long been known, and the liquid has been stated to yield a good indelible stamping ink. According to Herr Gawalowski (*Zeit. öst Apot.-Ver.*, Sept. 10, p. 485), the ammonium salt of anacardic acid ($C^{22}H^{32}O^{31}$), one of the constituents of the liquid, can be advantageously used as a means of darkening the hair. For this purpose the hair is first moistened with an aqueous solution of the salt and afterwards combed with a comb that has been dipped in a solution of ferrous sulphate, or the ammonium anacardate may be applied in a pomade or oil, and instead of the solution of ferrous sulphate an oleate of iron may be employed. It is stated that after a short exposure to the air the hair so treated assumes a more or less dark colour, which is tolerably persistent, but nothing is said as to the exact tint. It is obvious that anacardic acid used for this purpose must be quite free from the acrid cardol that accompanies it in the nut. Herr Gawalowski directs that it should be prepared by treating the residue from the evaporation of an ethereal extract of the crushed pericarp with water as long as the washings showed traces of tannic acid, then dissolving it in 15 to 20 parts of alcohol, shaking the solution vigorously with freshly precipitated lead hydrate, filtering and washing the precipitate with alcohol and decomposing the lead salt so obtained with freshly prepared sulphide of ammonium and filtering. Upon strongly cooling the filtrate, which contains the ammonium salt of anacardic acid and excess of ammonium sulphide, and treating it with sulphuric acid, the acid separates at once as a soft mass, which after being pressed between filter paper is dissolved in ammonia and then remains soluble in water. According to Dymock (*Veg. Mat. Med. W. Ind.*, p. 199), a tar obtained in roasting the nuts, and largely used in India for tarring wood, contains about 90 per cent. of anacardic acid and 10 per cent. of cardol. (*Pharm. Journ.*, Oct. 3rd, 1891.)

LEGUMINOSÆ.

A description of the preparation of Catechu or Cutch.

The merchants of Nasik, Gangapur, and other towns engage the services of the *Kátoris** for the purpose of manufacturing Catechu. It is usual with these merchants to descend into the Concan at the termination of the rains. They enter into an arrangement with several of the chief Naiks to proceed with them for the purpose of preparing the required quantity of Catechu. As the Kátoris are generally in debt to the grain-dealers of the different villages, near which they reside, the traders adjust matters with the grain-dealers by paying part, and becoming responsible for the balance of the debt, on the return of the Kátori to his old residence. The trader being joined by the Kátoris, the latter select a spot where the Khair trees (*Acacia Catechu*) are numerous. The merchant then begins to erect an extensive shed, but as he has only one or two servants and three or four matchlock men with him, he employs the Kátoris to build it.

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* कातोडी or कातकरी the name of a jungle tribe in Western India, whose principal occupation is the collection of कात or Catechu.

These sheds often cover one or two begahs of ground. In the centre a temporary dwelling is built, in which the merchant resides and lodges his supply of stores for the consumption of the Kátoris and his own establishment. The following are generally the articles in store: Rice, *náchni*, *urid*, onions, garlic, pepper, salt, turmeric, cocoanuts, cumin, asafœtida, salt-fish, ghi, oil, tobacco, steel, arrack, and various sorts of coarse cloths. These things are disposed of to the Kátoris at from 50 to 75 per cent. above their value in the neighbouring markets.

The Kátoris erect their *bhoongas* or huts around the merchant's shed, and in front of their hut they prepare the *tároo* or fire-place. They form the fire-place by digging a trench four or five cubits in length and one in breadth, which they cover at the top and leave the ends open to admit the air to pass freely through. In the top there are twelve small round holes to receive an equal number of pots.

Before they commence the operation of cutting any billets of wood, they perform certain propitiatory rites, by worshipping one of the Khair trees. Having procured a cocoanut, some red pigment, and a little frankincense, they select a tree for their purpose, rub the red pigment on the trunk near the root, burn the frankincense in front of it, and then break the nut; after which they join their hands in a supplicatory position, and address themselves to the tree, asking it to bless their undertaking, and to allow them to prepare abundance of good catechu. Having constituted the tree by this ceremony, a subordinate deity, which they term *Rán Sheo Wária*, they divide the consecrated cocoanut among those present. Each family possessing a fire-place performs a similar ceremony. They make one or two incisions in the trunk of the tree during these rites, but will not cut it down at the time, although these trees are sometimes cut down at a subsequent period.

The following day the Kátoris proceed into the jungle and examine the Khair trees. They, in the first instance, strike two or three blows with an axe deep into the trunk of a tree to obtain a chip from near the centre, and if, upon examination, it appears to have attained maturity, that is, if it is of a red colour (termed by them márhi), and there appears a white crust formed by the inspissated juice, they are satisfied the tree is a valuable one and they cut it down. These people have a superstitious dread of bad luck attending their operations, and they object to a person speaking while a tree, which they are cutting, is in the act of falling. The branches, bark, and the white portion of the wood are cut away when the tree has been felled, and it is then taken home. The length varies from four to six feet, and as the wood is extremely hard, the cutting of one billet is considered sufficient labour for the day. The next day, early in the morning, they cut these billets into chips; however, they are careful not to cut more at one time than may be required for the boiling operations of the day, as they think the chips would be too dry on the second day. To enable them more conveniently to cut these hard billets into chips, they drive three pieces of timber, each having forked branches, of different lengths, firmly into the ground about half a pace distant from each other, and the lowest being on a level with the earth. The billet is placed in a sloping position in the forks, and lies quite secure to be cut. The chips are heaped near the fire-place, after which the men take their breakfast, and then proceed to the jungle. The labour attending the boiling process always devolves on the females: the Kátori's wife or wives (for they sometimes have two or three), when she has finished her own breakfast, kindles the fire in the *tároo*, and then puts two handfuls of chips, neither more nor less, into ten of the pots, leaving the one at each end empty; water is poured in until it rises four fingers' breadth above the chips; this is ascertained by means of a small stick marked like a scale, the lines being distant from each other a finger's breadth.

It has been mentioned that there are twelve holes in each fire-place to hold that number of pots, but should the persons composing the family be sickly or old, they will most likely only use six pots; each of these pots will contain about three quarts of liquid. The pots at each end are only used during the second and third stages of the process. When the liquid has been well boiled and evaporated to a finger's breadth under the surface of the chips, they take the pots successively off the fire, and pour the liquid into one of the empty ones; after it has been well boiled in this, they apply the scale, and, if it is ready, they transfer it to the other empty pot. It is boiled down in this pot till it has attained what they consider the requisite degree of consistency, and then emptied into a trough made of the Pangara tree (*Erythrina indica*), as the timber is soft and readily absorbs water. The women now fill the pots with fresh chips, and the boiling process is thus continued until evening.

Should the liquid in any of the pots, during the boiling process, take a longer time than usual to thicken, some of it is taken out and put into one of those pots in which the chips remain and which had just been strained. Whenever they find the liquid overflow the pot from excessive ebullition, they sprinkle a little bran on it to make it subside.

When the men return home in the evening, each with his billet of wood, they examine the liquid deposited in the *ául* or trough, and, for the purpose of drying the substance and rendering it more adhesive, they use a piece of old *kamli* (country blanket), with which they keep stirring the liquid for two or three hours. They use the *kamli*, as the kát (catechu) does not adhere to it, and it is left exposed during the night that it may cool and become firm. If after the usual time they find the *kát* continues rather moist, and that it does not appear to possess a sufficiently adhesive quality, they bury it in the earth for three or four days, after which it becomes dark and hard, but the people never eat kát of this description; it is used by masons who mix it with lime.

By dawn in the morning the females are at work again; they take the kát out of the troughs in masses, and place it in baskets, to permit any remaining liquid to run off more freely, and at the expiration of three or four hours, they take the baskets to the merchant. Here they divide it into small lumps about the size of a fig. They give ten of these lumps for a *dhabbu* (half anna). They will sometimes manufacture a sufficient quantity to allow of their disposing of the value of eight or ten *dhabbus* in one day.

When the Kátoris deliver the fresh kát to the merchant, it is placed on the ground in the shade to dry, with a quantity of small chips previously scattered over the place, to prevent the earth adhering to the kát. It takes three or four days to harden; during this time, each of the little lumps is turned over once a day, and gently pressed with the hand to accelerate the drying process. The kát must always be dried in the shade, for if exposed to the heat of the sun it would dissolve and turn black.

The Kátoris are paid for the greater part in such necessaries as they may be in want of, and whatever balance remains is credited by the merchant to liquidate the sum due to the village grain-dealers for giving the Kátoris permission to quit their villages.

The Kátoris thus employed are not permitted to sell kát to other persons, and the merchant, to guard against any roguery on their part, has their huts searched daily.

The heat in the months of April and May puts a stop to the manufacture, as the kát will not thicken and dry when the atmosphere is very warm.

When the whole supply of kát has been dried by the merchant's people, it is piled into long heaps or ridges, and previous to its being removed from the jungle to his own house, he deems it necessary to propitiate the goddess Bhaváni. Accordingly, a coarse green *sárhi*, a *choli*, some glass bangles, a small-toothed comb, and a string of beads are placed on one of the heaps of kát; then some turmeric, red pigment, a casket or small box and comb (करंडा फणी), red lead, a cocoanut, and frankincense are placed near the *sárhi*, after which a sheep and fowl are sacrificed at the shrine.

It is said that the merchant reckons that he receives about ten seers* of the kát for the rupee. (*Major A. Mackintosh, Trans. Bom. Geograph. Soc.*, i., p. 331, 1838.)

Cæsalpinia Sappan.

Schreder, in the *Berichte der Deutschen Chemischen Gesellschaft*, 1872, 512, and 1879, 506, has shown that *Sappanin*, the crystalline colouring matter of Sappan-wood, is *not* identical with Brasilin.

Alhagi camelorum.

Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia*, p. 8) says:—"After all other shrubs and plants have dried up owing to the autumnal hot winds, this still remains of a vivid green, and is eagerly sought for as fodder by camels, donkeys, and goats. During certain seasons, and in special districts, when its fruit is beginning to ripen, the whole shrub becomes covered with tears of glass-like beads, the largest the size of a pea; this is the Manna produced on this shrub, called in these parts *tar-anjabin*, which is very extensively collected, both for local consumption and exportation."

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* The full seer of eighty rupees' weight, 2 lbs.

The ground-nut oil trade in Pondicherry.

The ground-nut oil trade of Pondicherry has increased enormously during the last few years: twenty years ago the total quantity exported amounted to only 1,403 casks, the whole of which was taken by Mauritius and Réunion; during the twelve months ending 31st December 1890, the total shipment rose to 18,485 casks, 7,503 being consigned to Rangoon and Moulmein; large quantities were also taken by Calcutta, Coconada, Singapore, and Penang. The oil trade with Burmah, which scarcely existed eight years ago, has now risen to a steady demand for about 700 candies a month. The oil is put up in English beer hogsheads holding 440 lbs. each, and in Cochin oil casks containing 550 lbs. each. The tabulated tables given below show the total shipments, and the highest, lowest, and average prices for certain given periods. The ground-nut kernels are crushed exclusively by the ancient wooden presses of exactly the same pattern which have been used for several centuries; about 1,200 of these mills are employed in crushing the kernels—800 at Vilvanur, a village in the Villapuram taluq, eighteen miles west of Pondicherry, and 400 in Pondicherry and the neighbouring communes: the trade is entirely in the hands of native operators, who buy and crush the nuts, and ship and sell the oil without the intervention of any European agency. A company was started at Pondicherry a few years back for erecting and working a *huilerie* to be worked by steam power, and in due time the mill commenced crushing, but the results were unfavourable, the cost of working and of the raw material being largely in excess of the value of the oil produced; after persevering for upwards of two years, company No. 1 decided to close up the concern by liquidation; but for some time no purchaser could be found, and it was therefore resolved to sell off the property by public auction, but "bidders," were not forthcoming, and as a last expedient the factory *en bloc* was transferred to a small party composed of original shareholders, for a mere song. This company No. 2 soon came to grief, and finding the losses on working to be more than they cared to bear, the mill was again closed and advertised for sale. After a considerable delay a Calcutta firm bought the property, and having made various improvements in the machinery, set vigorously to work at crushing, but with no better result than that obtained by companies Nos. 1 and 2; and the factory was again closed for the third time in about as many years, and company No. 3 retired. And now the end of Pondicherry *huilerie* has come, and the machinery is being taken down and conveyed to Bangalore, where it is to be re-erected and worked for crushing ground-nut kernels: Bangalore has already one steam oil mill, and it has to be seen whether two can be made to pay. The complete failure of the several attempts made to work the Pondicherry factory is attributed to various causes, of which the following are the chief:—*First*, the inefficiency of the machinery generally, and of the engine and boiler in particular, which caused an extravagant consumption of fuel to obtain minimum results; *second*, the absence of a practical engineer thoroughly acquainted with oil crushing machinery; *third*, the want of a sufficient working capital so as to purchase the raw material, fuel, &c., in advance, when prices were low; and *fourth*, the want of unanimity among the owners. The results, however, were so far valuable, that they demonstrated the fact that the crushing of ground-nut kernels by improved steam machinery of a modern type would yield large profits, provided it was efficiently supervised and economically worked: it was found that the outturn from steam crushing was nearly 4 per cent. greater than what was obtained from native presses, while the quality of the oil was so much superior that it fetched fully 3½ per cent. more in the Burmah, Singapore, and Indian markets. The export of the ground-nut oil trade developed only about 1875, when 9,150 casks were shipped, including 1,581 to Bordeaux, 1,036 to Marseilles, 572 to London, 207 to Havre, and 200 to Martinique; but the trade with Europe stopped when Marseilles began crushing on a large scale, and during the last twelve years there have been no transactions. The use of the oil for cuisine purposes is extending every year, especially among all classes of Indians, and particularly with Indian emigrants working in foreign countries. The 12,000 casks shipped yearly to Burmah and Mauritius are consumed chiefly by Indians, and it is likely that Natal and other places where Indian labour is employed will presently become large consumers. Ground-nut oil is not much used by Europeans, as the taste of the kernel is rather strong, unless properly manipulated; many native cooks, however, clarify it so thoroughly that it is rendered tasteless, and equal, if not superior, to ordinary olive and salad oils. The process is a very simple one, but great care and judgment are necessary to insure success: if the clarifying secret were better known, the oil would, no doubt, to a large extent, take the place of *ghee*; it is much better for cooking purposes, far cheaper, and more readily transported, while it cannot be easily adulterated. The consumption of the *huile d'arachides* seems to follow on the track of Indian emigrants: in 1880 there were but very few Indians settled in Singapore, Penang, &c., and in that year the export of ground-nut oil amounted to only 10 casks; in 1890 the shipments to these two ports amounted approximatively to 1,800 candies. The future of the export oil trade seems to wear a decidedly bright appearance, and there is no apparent reason why the development of the last few years should not continue at the same ratio for at least some years to come. The value of the traffic to Pondicherry is very great: besides the labour required to work the native mills, employment is given to a large number of coopers and others in preparing and shipping the casks. The following statement shows the total number of casks exported for the periods named below :—

Number of casks	1885.	1886.	1887.	1888.	1889	1890.
exported	10,403	10,256	17,727	16,093	19,365	18,485

It will be seen by the above that the shipments during the last four years have not materially changed; the period of 1889 was exceptional, the ground-nut crop being unusually large, and the prices generally low.

The statement given below exhibits the highest, lowest, and average rates, per French candy of 529 lbs. English, during the several years mentioned:—

	1875.		1880.		1885.		1890.	
	Rs.	a.	Rs.	a.	Rs.	a.	Rs.	a.
Highest quotations per candy ...	49	0	70	0	67	0	86	0
Lowest per candy	32	12	51	14	52	0	55	0
Average do.	40	3	59	8	55	14	62	4

The exceptional low prices for 1875 are accounted for by the unexpected heavy crop of kernels, which was greatly in excess of the foreign demand, which caused the rates to rule low, and to offer unusually good advantages to local crushers. (*Times of India*, March 31st, 1891.)

PONDICHERRY, 27*th April* 1893.—The number of casks exported in 1892 was the lowest since 1887, in which year the purchases for

Upper Burma first commenced. The high price of kernels throughout the season was no doubt the main cause of the falling off, but it is noticeable that there was a considerable decrease in 1891, when both nuts and oil were comparatively cheap. The average number of casks shipped yearly from 1887 to 1890, both inclusive, was 18,068, as compared with 15,390 for 1891 and 1892. The average quotations of the oil, for the same periods, were Rs. 59 and Rs. 70, respectively, per French candy of 529 lbs. The trade with Calcutta, the Straits and Coast ports shows no signs of improvement, while Mauritius and Bourbon figures remain pretty much the same as in former years. The ground-nut oil trade—at least so far as its consumption is concerned—is an enigma. In Bourbon and Penang, where Indians monopolise the labour markets, very little of this generally indispensable culinary article is used, while in both Upper and Lower Burma the consumption is enormous, although the Indian population is, comparatively, very much less than it is in the former colonies. We must assume that the native Burmese is the better customer of the two. The price of the oil has risen in greater proportion than that of ground-nuts. In 1875 the highest quotation was Rs. 49 per candy and the lowest Rs. 32-12-0, when in 1892 the rates were Rs. 86-8-0 and Rs. 69, respectively. As in the case of the kernels—which are grown almost exclusively on British soil—the great bulk of the ground-nut oil shipped at Pondicherry is manufactured in English territory, the village of Valavanur, a station on the Pondicherry-Villapuram Railway, supplying the greater part. The trade is entirely in the hands of native operators. The approximate value of last year's shipments may be taken at 11¼ lakhs of rupees. For the current year the prospects are, so far, encouraging. In spite of the high prices of the kernels, the shipments from the 1st January to the 31st March amounted to 3,928 casks, as compared with an average of 3,888 casks for the same period during the preceding four years. The average price was Rs. 73,140 per candy, the highest Rs. 79-8-0, and the lowest Rs. 65-8-0, against Rs. 67-5-0, Rs. 83-8-0, and Rs. 58-12-0, respectively. (*Madras Mail.*)

Crotalaria paniculata.

Dr. Mootoosawmy, in March 1890, sent a specimen of this plant for identification. It is used as a fish poison in Tanjore and other places in Southern India, and is known by the Tamil name

Valithe-pundu. An alcoholic extract of the plant had a strong odour of benbane, and contained a soft resin, a tannin, and an alkaloid, the latter being the active principle. (*D.H.*)

Crotalaria retusa, *Linn. Bot. Mag., t.* 2561 ; *Rheede, Hort. Mall. ix., t.* 25.

Greshoff (*Med. uit. S'lands Plant*, vii., p. 31) has shown that the leaves of this common plant, the Bil-jhanjhan of Bengal, the Ghágri of Bombay, and Potu-galli-gista of Southern India, contain a considerable quantity of *indican* ; and that the seeds contain an alkaloid which is a strong poison, and is probably closely related to the poisonous alkaloids of Cytisus, Ulex, Spartium, and Lupinus.

The same base was found in larger quantity in the seeds of *C. striata*, DC. *Bot. Mag., t.* 3200 ; *Reich. Icon. Exot., t.* 232.

Millettia atropurpurea, *Bent. Wall. Pl. As. Rar., t.* 78.

Greshoff (*Med. uit. S'lands Plant.*, vii., p. 33) has shown that the seeds contain a glucoside similar to, if not identical with, *saponin.* The plant is employed as a fish poison in the Dutch East Indies; it is also a native of Martaban, Tenasserim, Malacca, and Penang.

Pithecolobium bigeminum, *Mart.*

According to Greshoff, the bark contains 0·8 per cent. of a non-volatile, amorphous alkaloid, which forms crystalline salts, and separates as a heavy, yellow oil on the addition of alkalies to solutions of the latter. With 100 parts of water, it forms a turbid liquid, which on warming assumes the appearance of milk, but becomes clear on the addition of an acid. The solutions have a burning taste, and give the usual alkaloid reactions. It has a strong corrosive action on the skin, and is fatal to fish in a dilution of 1 : 400,000. The same compound appears also to occur in *P. Saman*, Benth. (*Meded. uit S'lands Plant.*, vii., p. 38.)

Derris elliptica, *Benth. Wight, Ic. t.* 420.

The roots of this handsome climbing shrub, according to the Kew Report of 1877, afford a useful insecticide for agricultural purposes, and are also used to kill fish. The Malays are said to use the bark as one of the ingredients of their arrow poison.

According to Greshoff (*Meded. uit. S'lands Plant.*, vii., p. 12) it has a powerfully poisonous action on fish, a decoction of the roots being fatal even when diluted with 300,000 parts of water. The only active constituent isolated is a resinous substance termed *derrid*, which does not contain nitrogen, and is not a glucoside; it readily dissolves in alcohol, ether, chloroform, and amyl alcohol, but is very sparingly soluble in water and potash solution. On fusion with potash, it yields salicylic and protocatechuic acids. It occurs almost entirely in the cortex of the root, but has not yet been obtained pure. Its alcoholic solution has a slightly acid reaction, and a sharp aromatic taste, causing a partial insensibility of the tongue, which remains for hours. A solution of 1 part in 5 millions is almost instantly fatal to fish. A very similar compound is found in the seeds of *Pachyrhizus angulatus*, Rich., a decoction of which is quickly fatal in a dilution of 1:125,000. It is probably identical with derrid, but until this has been experimentally proved it may be distinguished as *Pachyrhizid.* It is very readily prepared from *Pachyrhizus*, which occurs in all tropical countries, as the tannin compounds, usually so difficult to separate, are not found in this plant. The seeds also contain a non-poisonous, crystalline compound, which is readily soluble in alcohol, and has at 30° the consistence of butter.

Sophora tomentosa, *Linn.*

The plant formerly renowned as a medicine ("*Anticholerica Rumphii*") contains a poisonous alkaloid, soluble in ether, which is contained in largest quantity in the seeds. A small quantity of this substance, received by Professor Plugge as a thick red-brown fluid, when tested physiologically, gave results indicating the probability that it is identical with cytisine, the alkaloid of laburnum seeds, and this probability was strengthened by the results of such chemical and spectroscopical tests as were possible with the small quantity of material available (*Archiv. d. Pharm.*, ccxxix., 561). Alkaloids have previously been found in *S. speciosa* and *S. angustifolia*, but have not been closely investigated.

Abrin.

P. Ehrlich (*Deutsche Med. Wohenschrift*, 1891, No. 14) compares the toxic properties of Abrin with those of Ricin. Injected hypodermically, he finds abrin (Merck's) to be only half as poisonous as ricin; taken internally, it is still less active.

Subcutaneous injections in mice seldom produce the necrosis so commonly observed when ricin is injected, but invariably cause epilation at the seat of the injection. On the other hand, the action of abrin upon the conjunctiva is much more powerful than that of ricin. Ehrlich has succeeded in producing an immunity to the action of abrin similar to that obtained with ricin (*cf.* Vol. III., p. 305). Animals thus rendered refractory present a general and local immunity to the action of the poison; they bear without injury doses four times as large as those which would prove fatal to an unprotected animal, whether administered internally or injected beneath the skin. Absolute immunity of the conjunctiva to the action of abrin may be obtained by its internal administration for several weeks. From these facts the author concludes that a substance, which he calls anti-abrin, is developed in the blood which completely counteracts the action of the poison.

Immunity to the action of abrin affords no protection against the action of ricin, nor does the administration of ricin lessen the activity of abrin; a rabbit whose conjunctiva had been rendered insusceptible to the application of solid ricin suffered from an intense conjunctivitis when a solution of 1 : 10000 of abrin was applied to the part.

ROSACEÆ.

Otto of Roses.

The results of the investigations on Rose Oil, which have been carried on for a long time in the Pharmaceutical Institute of Breslau University, have been published by U. Eckart (*Archiv. der Pharmacie,* 229 [1891], 355). A body $C^{10}H^{18}O$, which is called "Rhodinol," forms the chief constituent of both German and Turkish otto; it boils at 216°—217°, and shows all the reactions of an alcohol. With acetic or benzoic anhydride it forms esters, which, however, during distillation, dissociate again into their constituents. By treatment with halogen hydro-acids, Rhodinol chloride $C^{10}H^{17}Cl$, Rhodinol iodide $C^{10}H^{17}I$, and so on, are obtained. Oxidation with potassium bichromate and sulphuric acid converts Rhodinol into an aldehyde, which the author calls "Rhodinal" and which is believed to be identical with Citral. By phosphoric anhydride Rhodinal is transformed in Dipentene in abstracting a molecule of water. (*Ber. von Schimmel & Co.*, Oct., 1891.)

COMBRETACEÆ.

Myrobalans.

G. Zoelfell (*Arch. der Pharm.*, 1891, 123—160) states that the tannin of myrobalans is a mixture of two tannins, one of which is the glucoside of gallic acid, yielding upon hydrolysis gallic acid and sugar (dextrose); the other tannin present is a tannic acid proper of the formula $C^{10}H^{10}O^{10}$, which at 100° C. loses two molecules of water. The anhydrous acid $C^{14}H^{6}O^{8}$ is called ellagic acid (the formula of which is generally given as $C^{14}H^{8}O^{9}$); the hydrated acid $C^{10}H^{14}O^{10}$ is called ellaggenic acid; the latter forms a penta-acetyl derivative, indicating five and four hydroxyl groups, respectively, in the acids. The tannins were separated by fractional precipitation with lead acetate, subsequently purified by precipitation with sodium chloride and solution in acetic ether.

Terminalia chebula.

Mr. A. Campbell Stark submitted a paper on the "Preliminary Proximate Analysis of a sample of commercial Myrobalans" to the Pharmaceutical Conference, August, 1892.

A finely powdered and well-mixed sample yielded 7·05 per cent. of moisture and 2·3 per cent. of ash—

Petroleum Ether Extract	Free fatty acid	·482
	Wax	·428
Ethereal Extract	Gallic acid	3·02
	Tannin	1·80
	Green resin	·54
	Brown resin	·97
Alcoholic Extract	Tannin	18·80
	Bitter principle	1·9
	Glucose	1·13
	Saccharose	1·25
	Phlobaphane	·86
	Colouring matter	·35
	Pale green substance	·71
Aqueous Extract		5·10

The soft green resin found in the ethereal extract is presumably the "Myrobalamine" of Dr. Apery. The tannin was estimated in the aqueous solution of the alcoholic extract by means of copper acetate, including that also found in the ether extract: it amounted to 20·6 per cent., a lower percentage than that quoted by other investigators, who give the average of tannin in myrobalan from 20 to 40 per cent.

Terminalia belerica, *Roxb.*

We have made the following experiments with the seeds of the large-fruited variety of this tree (see Vol. II., p. 5, *et seq.*):—9·5 grams of the kernels, equal to 22 in number, pulped with raw meat were eaten by a fasting cat at 11-40 A.M. At 2·30 P.M. the animal vomited several times, ejecting a number of worms and some fluid, but no meat. 4 P.M. vomited bile-stained, frothy fluid, looks somewhat distressed. No other symptoms were noticed, and on the following morning the cat was in its normal state.

Our experiments thus appear to indicate the absence of any narcotic principle, but a substance which possesses emetic properties is probably present.

MYRTACEÆ.

Clove Culture in Zanzibar.[*]

Zanzibar is noted for being the principal source of the world's supply of cloves, and a report on the cultivation of this article of domestic economy may prove of interest.

When speaking of Zanzibar, we include the islands of Zanzibar and Pemba, three-fourths of the entire crop of cloves being produced in Pemba. Those grown on the island of Zanzibar are reckoned of superior quality and command the better price, but this is probably due to the fact that the owners reside here, and can thus give their affairs the benefit of direct supervision.

Certainly the conditions for their successful cultivation are most favourable at Pemba, where the rainfall exceeds that of Zanzibar, but the management being left to careless overseers, the result is the cloves are imperfectly cured and (but little care being observed in handling) are frequently marketed in an inferior condition.

The clove tree was first introduced into this country by the then Sultan, Seyed Said bin Sultan, about the year 1830, since which time its cultivation has gradually extended, until it is now the chief industry of the islands.

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[*] Report of Consul Pratt. Reprinted from the *Oil, Paint, and Drug Reporter.*

The industry received a check in 1872, the date of the great hurricane. At least nine-tenths of the trees were destroyed at that time, so the larger part of those now standing are of new growth.

A peculiarity of the clove tree is that every part is aromatic, but the greatest strength is found in the bud, which is the "clove" of commerce. The finest quality of cloves are dark brown in colour, with full, perfect heads, free from moisture.

In the cultivation of the clove, the first thing to be done is the starting of the shoot. The seeds are planted in long trenches and are kept well watered until after sprouting. In the course of forty days the shoots appear above ground. They are carefully watered and looked after for the space of two years, when they should be about 3 feet in height. They are then transplanted, being set about 30 feet apart, and are kept watered till they become well rooted. From this time on the young trees require only ordinary care, though the best results are obtained when the ground about the trees is well worked over and kept free from weeds.

The growth of the tree is very slow, and five or six years are required for it to come into bearing, at which time it is about the size of an ordinary pear-tree, and is usually very shapely. It is a pretty sight to see a young plantation just coming into bearing. The leaves, of various shades of green tinged with red, serve to set off the clusters of dull-red clove buds.

As soon as the buds are fully formed and assume this reddish colour, the harvesting commences, and is prosecuted for fully six months at intervals, since the buds do not form simultaneously, but at odd times throughout the whole period. The limbs of the tree being very brittle, a peculiar four-sided ladder is brought into requisition, and the harvesting proceeds apace.

As fast as collected, the buds are spread out in the sun, until they assume a brownish colour, when they are put in the storehouse and are ready for market.

A ten-year-old plantation should produce an average of 20 pounds of cloves to a tree. Trees of twenty years frequently produce upwards of 100 pounds each.

The present season, commencing with July, 1889, is very favourable, and the crop will exceed that of any previous season. It will, in all probability, amount to 13,000,000 pounds, averaging a local value of 10 cents per pound.

The Sultan derives no inconsiderable portion of his revenue from this source, since the duty is levied at 30 per cent. *ad valorem*, thus placing to the Sultan's credit for the present year nearly, if not quite, $400,000.

Besides the clove buds, the stems are also gathered, and form an article of commerce, commanding about one-fifth of the price of cloves and having about the same percentage of strength. To this circumstance is due the fact that ground clove can frequently be purchased in the market at a lower price than whole cloves.

For the past fifteen years the cultivation of cloves has been the chief occupation of the Arab planters, and has always netted good returns. It seems probable that it will continue to be a profitable crop, since the consumption of the article appears to keep pace with the inevitable increase of production.

Up to the present time the plantations have been worked with slave labour at comparatively small expense; but with stoppage of slave supplies from the mainland, great difficulty will be experienced by the planters during harvest time. One result will be an increase in expenses; but what the planters have most to fear is that the curtailment of the labour-supply will entail a direct loss by rendering it impossible to harvest the crop until after it has blossomed, when it would be unfit for the uses of commerce.

Oil of Cloves.

The value of this oil depending upon the quantity of eugenol present, H. Thoms proposes the following method of assay, depending upon the formation of benzoyl-eugenol (see *Am. Jour. Pharm.*, 1891, 406): 5 gms. of the oil, 20 gms. solution of sodium hydrate (15 per cent.), and 6 gms. benzoyl chloride are placed in a tared beaker of 150 cc. capacity and thoroughly mixed, this causing the mixture to become quite hot; after cooling 50 cc. water are added and heat applied until the crystalline mass melts, and again allowed to become cold; the clear liquid is run through a weighed filter (dried at 101°C.), and the same operation of washing the crystals repeated twice with 50 cc. water. To remove the sesqui-terpene, which may contaminate the benzoyl-eugenol, the crystals have to be washed with alcohol; this is effected by adding to the still moist crystalline mass in the beaker 25 cc. alcohol of 90 per cent., warming until solution is effected, rotating the solution until the crystals begin to separate again, then allowing the contents of the beaker to cool to 7° C.; transferring to the weighed filter and washing with a little 90 per cent. alcohol until the filtrate measures 25 cc.; the filter with contents is then at once transferred to the beaker, dried at 101° C. and weighed. To the weight of the benzoyl-eugenol must be added 0·550 gm., the amount soluble in 25 cc. 90 per cent. alcohol; this weight multiplied by 164 (the molecular weight of eugenol) and divided by 268 (the molecular weight of benzoyl-eugenol) gives the amount of eugenol in 5 gms. oil; for the percentage multiply again by twenty.

An examination of sixteen samples showed the eugenol to vary from 76·87 per cent. to 90·64 per cent.; the oil distilled from the stems was found (contrary to expectations) to contain a high percentage of eugenol, 83—85 per cent.; the specific gravity of the oil was not found to agree with the percentage of eugenol as the following show: 1·059 = 83·2 per cent.; 1065 = 80·89 per cent.; 1·065 = 82·77 per cent.; 1·0615 = 84·10 per cent.; 1·0655 = 90·64 per cent.; 1·061 = 81·18; this led to the belief that there must be a third constituent present in the oil, for if there were only eugenol and sesqui-terpene the specific gravity should vary in accordance with the percentage of eugenol. (*Pharm. Centralhalle*, 1891, 589. *Am. Journ. Pharm.*, Jan., 1892.)

PASSIFLOREÆ.

Carpaine, the alkaloid in the leaves of Carica Papaya.

A new alkaloid has recently been detected in papaw leaves by M. Greshoff, of the Chemico-Pharmacological Laboratory at Buitenzorg in Java. It was obtained by digesting the powdered leaves in spirit acidulated with acetic acid, removing the spirit by distillation, and treating the resulting extract with water so as to leave behind resin and chlorophyll. The aqueous solution was then shaken repeatedly with ether, and carbonate of soda was added until an alkaline reaction was evident. The precipitate thus obtained was readily soluble in ether, and on evaporation of the ether the " carpaine " was obtained in colourless rosettes of crystals to the extent of about 0·25 per cent. of the leaves employed. Although the freshly pecipitated alkaloid is readily soluble in ether, when once crystallized it redissolves but slowly, so that the crystals can be purified and rendered perfectly white by washing with a little ether, but the percentage obtained is thus reduced to 0·15 per cent. On a large scale the lime and petroleum method gives very good results, about 0·19 per cent., and would probably be preferred on the score of expense. Comparative experiments made on the young and old leaves freed from the stalks show that the old leaves afford when dried 0·072 per cent. of the alkaloid, the young leaves 0·25 per cent., and that on an average a papaw plant can be calculated to afford 30 grams of the alkaloid per year from the leaves. The hydrochlorate of carpaine, which contains about 82 per cent. of the pure alkaloid, is freely soluble in water. As yet comparatively little is known of the physiological action of the alkaloid. It appears, however, to act more especially upon the heart, slowing its action. The lethal dose for a fowl of 500 grams weight was found to be about 200 milligrams. In a fowl of 350 grams weight no poisonous symptoms were produced with 50 milligrams of the alkaloid; with 100 milligrams symptoms of poisoning occurred in ten minutes after injection into the breast muscles, but after twenty-five minutes the animal recovered its normal condition. The bird lay on its side and breathed deeply in a jerky manner, and showed slight convulsive movement of the whole body, but no irritability was noticed. Further observations are necessary to determine the usefulness or otherwise of the alkaloid in medicine; should it prove of utility, there can be no difficulty in obtaining it in almost unlimited quantity and in a definite crystalline condition. The alkaloid is easily precipitated from its solutions by the alkaloid reagents. The most delicate reaction is with Mayer's reagent, iodoiodide of potassium, which in a solution of 1 in 300,000 gives a turbidity, and in 80,000 parts an evident precipitate; phosphomolybdate of ammonium has its limit of reaction at 1 in 75,000 parts, picric acid at 1 in 30,000, and chloride of gold at 1 in 25,000. The alkaloid has a bitter taste, which is perceptible even in a solution of 1 part in 100,000.

CUCURBITACEÆ.

Constituents of Melon Seeds.

C. Forti (*Chem. Centr.*, 1890, ii., 581) found these seeds to contain cholesterin and a dextro-rotatory carbo-hydrate apparently belonging to the galactan group.

The oil yielded by the seeds to ether amounts to 49 per cent., and is almost free from fatty acids. It contains lecithin. The phosphorus amounts to about 0·02 per cent. (*Year-Book of Pharm.* 1891, p. 194.)

UMBELLIFERÆ.

Anethum.

(*Peucedanum graveolens*, Benth.)

A distillate from Indian dill seed is reported to have shown besides a difference in the aroma, a considerable variation in chemical composition from oil distilled from German seed. From the distillate from Indian seed there was a remarkable separation of a constituent heavier than water, the nature of which has not yet been determined. The specific gravity reached 0·970, and the optical, rotation +41° 30′. German dill oil consists of limonene and carvol and has an average specific gravity of 0·910. (*Ber. von Schimmel & Co.*, Oct., 1891.)

Dorema Ammoniacum.

Under the name of بریر (bury) we have received from Afghanistan the root of this plant.

Anisun.

Under this name we have received Hemlock fruit from Afghanistan.

ARALIACEÆ.

Panax Ginseng.

Davydow (*Pharm. Zeitschr. f. Russl.*, 1890, pp. 97, 113, 130) has taken up the analysis of this root made by Garrigues (*Am. Jour. Pharm.*, 1854, p. 511). For panaquilon he uses the following process: The finely powdered root is repeatedly extracted with cold water until it shows no acid reaction. The several aqueous extracts were united and treated with animal charcoal, filtered and evaporated to dryness. The residue is dissolved in boiling 95 per cent. alcohol, filtered, and the alcohol recovered. Panaquilon remains as an amorphous, light yellow mass, easily soluble in alcohol and water, insoluble in ether, and does not contain nitrogen. Concentrated sulphuric acid gives a blood-red colour, gradually turning to a reddish violet. Panaquilon is neither an alkaloid nor a glucoside. On boiling with dilute sulphuric acid a crystalline powder, panacon, separates, which is insoluble in water and ether, but soluble in alcohol. Concentrated sulphuric acid dissolves and colours it purplish red.

Concentrated nitric acid oxidizes it to oxalic acid. Garrigues gives the following formulæ: Panaquilon $C^{24}H^{25}O^{18}$, Panacon $C^{22}H^{19}O^{5}$ (O=8). (*Am. Journ. Pharm.*, July, 1890.)

RUBIACEÆ.

Randia dumetorum.

Sir J. Sawyer (*Lancet*, Mar. 21, 1891) has employed a tincture of the fruit made with spiritus etheris, B. P., as a nervine calmative and antispasmodic; the dose is from 16 to 30 minims in water, but the strength is not stated. We have already shown that the drug contains saponin and valeric acid.

Ixora parviflora.

P. S. Mootoosawmy has sent us a sample of the bark of this tree, with the remark that it is used in native medicine, mixed with a decoction of ginger, for anæmic diseases; he suspected the presence of iron in it. The bark contained a little fatty matter, tannin, red colouring matter and 11·5 per cent. of ash consisting of the usual constituents, with only a trace of ferric oxide. The decoction of the bark was of a deep red colour, which probably suggested its medicinal employment.

Note on Catechu.

In the Library of the Botanic Garden at Oxford I recently came across a book which apparently escaped the observation of the indefatigable authors of *Pharmacographia*, entitled "Ehrenfridi Hagendornii Medicinæ D. et Pract. Gorl. Tractatus Physico-Medicus de Catechu sive Terra Japonica in vulgus, sic dicta ad normam Academiæ Naturæ-Curiosorum. Jenæ, 1679." This gives very interesting particulars respecting the history, nomenclature, and physical characters of Catechu.

"De patria Catechu." The author writes:—"Si Catechu agnomen respicias, quod Japonica etiam indigitetur, facilis esset decisio, quem agnoscat *locum natalem*. In ambiguo tamen usque est, an in Japonica vel præparetur vel aliunde ad Japonenses transportetur. Ex aliis finitimis locis in *Malaccam* et Sinam exportari." The italics are mine.

"De differentiis Catechu," "Duplicis generis quod sciam, innotuit Catechu hactenus. Una magisque communis Catechu species apparuit rubicundior, ad nigredinem veluti quandam inclinans, cum striis albicantibus, instar linearum per totum Catechu subjectum excurrentibus, itemque ponderosior compacturque. *Altera* a me visa fuit compacta, nec ita colorata, colore potius ad albedinem inclinante, porosior item, levioris ponderis, digitis quoque frangi facile terrique sustinens, nec Rae rubicundioris, ceu altera, adeo ferax."

Other differences are noted. Whether the pale variety alluded to be the cutch of North India I am unable to say. May it not be the Gambier cutch? If so, this will be a very early notice of that drug.

In another chapter of "De Electione Catechu" the writer says:—"Usus obtinuit, ut si de notis bonitatis indijudicandis medicinalibus certiores esse velimus, ad manus asservemus exemplum quoddam, ad quod tanquam ad Lydium lapidem pensiculanda pensiculemus eaque si bonitate cum examplo conveniant, retineamus sin minus, aversemur. Hinc cum duæ hactenus Catechu species sese mihi obtulerint, illam putaverim alteri preferandam, que saturatiori se commendat rubedine, quæ compactior, quæ ponderosior, quaque minus participat de lapillis, seminibus, lignis aliisque inibi interdum repiriri solitis. Quâ fini etiam apud aromatarios jam receptum est, ut integros Catechu globos prius malleo contundant, visuri, quænam sit species, ne pallidiore et viliore ob metum adulterationis, qua Japonenses ut plurimum malè audiunt, emptores defraudent.

"Sec. 2. Notari tamen expedit, suggerente id qualicunque experientiâ meâ utramque suam mavere posse laudem: *Rubicundiorem* cum opus est peculiari multaque adstrictione; *Pallidiorem* vero, ubi magis præcipitandi et absorbendi, humores vitosos intentio est, modo prius probe à lapillis et depuretur."

Section 3 is devoted to the 'Pharmaceutica'; section 4 to 'Therapeutica.'

One prescription may be quoted, for it gives an example of the early use of the word chocolat—

℞ Conserv. rosar-antiq.	℥j.
Flor borrag	℥ss.
Chocolat	ʒij.
Catechu	ʒj.

Vin. Malvat. q. s. cum $_{\circ}{}^{\circ}{}_{\circ}$ cinnam, rosar. ā. g. j. M. sic viro cuidam primario in eructatione ventriculi, quâ præmodum constictabatur. (*By G. Claridge Druce, Pharm. Journ., Jan.* 1892.)

VALERIANEÆ.

Valeriana Wallichii.

Aitchison (*Notes on Prod. of W. Afghanistan and N.-E. Persia*, p. 96) states that *gur-bálchorak* is a trade name for the roots of this plant in Afghanistan. He remarks:—"A Kabul trader at Leh told me that it was the same as *gur-balchorak* in the Peshawur trade, and owing to a load of which he was once nearly driven mad in conveying it from Kabul to Peshawur, by all the cats in the country surrounding him at night, wherever he halted." Aitchison supposes the name to be a contraction of *Gurba-bálchorak*, which would signify "the cat valerian."

COMPOSITÆ.

Solidago Virga-aurea.

Dr. Mascarel is said (*La France Médicale*, Oct. 8, 1889) to have used the plant very successfully in cases of dropsy. It has long been used by country practitioners to produce diaphoresis. It grows plentifully in the Northern parts of the United States, and resembles *Sol-odora*, the "sweet-scented golden rod," or "blue-mountain tea." In administering it for cardiac dropsy, Dr. Mascarel reduces the dried plant—stems, leaves and flowers—to a coarse powder, and gives it in doses of one tablespoonful, beaten with an entire egg (yolk and white). He gives but one dose on the first day; but on each of the following days he adds a tablespoonful, until seven or eight doses are being taken during the twenty-four hours. The diuresis is said to continue until œdema permanently disappears.

Helenin in Tuberculosis.

Helenin has now for some time been before the medical public as a remedy in phthisis, but without any apparent progress in its use. Dr. T. J. Bokenham has published an account of numerous experiments made by him as to the real value of the substance, and so far as can be gathered from the account given in the *British Medical Journal* (Oct. 17, p. 838) it would appear that the crystalline bodies occurring in *Inula Helenium* are difficult to separate on a large or commercial scale, and that consequently alantic anhydride was the only substance procurable commercially for his experiments. The other crystallized bodies were, however, obtained in sufficient quantity for laboratory experiments. These experiments showed that any of the crystalline bodies would prevent the growth of the tubercle bacillus if present in the proportion of 1 in 10,000, and in any ordinary cultivating medium for this bacillus. The effect of the administration of the alantic anhydride appeared to be to prolong life for a time in the animals experimented on, but not to prevent a fatal result. Helenin has also been lately given with good results in leucorrhœa in the dose of 2-4 centigrammes (*Rép. de Pharm.*, Oct., p. 481). (*Pharm. Journ.*, Oct. 31, 1891.)

Pluchea lanceolata.

Description.—Shrubby, hoary pubescent, with sessile, very coriaceous, oblong or oblanceolate entire leaves, one to two inches in length, having strong very oblique nerves on both surfaces. When dry, the leaves are of a pale yellowish-green. Heads of flowers in compound corymbs about the size of Groundsel, purple, involucre bracts contracted at the mouth, outer bracts obtuse, hoary. The drug has no marked taste.

Chemical composition.—The taste of these leaves is saltish and aromatic. They yield, in an air-dried state, 16·93 per cent. of mineral matter, consisting largely of alkaline chlorides, the cubical crystals of which were deposited on inspissating the alcoholic and aqueous extracts of the plant. Caoutchouc, and an organic-acid giving a green precipitate with ferric salts, were present, but no alkaloid. We have tried some experiments with preparations of Pluchea leaves, and conclude that, weight for weight, they are much weaker than senna leaves in their cathartic action.

The Existence of a Mydriatic Alkaloid in Lettuce.

The attention of the author was drawn a few months ago to the mydriatic action of an extract prepared at Hitchin from common lettuce, *Lactuca sativa*, when in flower. On examination, the mydriatic action was found to be due to an alkaloid. The extract closely resembled belladonna extract in appearance, smell, and taste; but a dose of 5 grains had been taken without injurious effects. Three other commercial extracts of lettuce were examined—namely, an extract of wild lettuce, *Lactuca virosa*, prepared according to the directions of the British Pharmacopœia, the history of which was unknown, and extracts of both the wild and the cultivated lettuce prepared at Market Deeping, in Lincolnshire. An extract of that variety of the cultivated plant known as Cos lettuce was also examined. They all contained an alkaloid which had a very marked power of dilating the pupil of the eye. Finally, a dried specimen of wild lettuce, collected when in flower, was examined. It contained a mydriatic alkaloid.

The impure alkaloid obtained from the extract was a light brown syrup, which possessed powerful mydriatic properties. In order to purify it, it was converted into the oxalate. The alkaloid recovered from the pure oxalate, when crystallized from chloroform, closely resembled hyoscyamine, both in appearance and in melting point. The aurochloride was then produced by the usual methods, and this, after recrystallization, was obtained in the shining flat needles characteristic of the aurochloride of hyoscyamine. The estimation of the gold and the base in this compound showed that the alkaloid was one of three isomeric mydriatic alkaloids, having the formula $C^{17}H^{23}NO^{3}$, while its melting point was 159·75° (corr.), and closely corresponded with that ascribed by Ladenburg to the aurochloride of hyoscyamine. The plant does not appear to contain a second mydriatic alkaloid, although it must be remembered that only small quantities of material were operated upon.

The author has just shown that both wild and cultivated varieties of lettuce, especially when the flowering stage is reached, contain hyoscyamine, the mydriatic alkaloid occurring in *Hyoscyamus niger*, *Atropa Belladonna*, and other plants belonging to the natural order *Solanaceæ*, and it is probable that to the presence of this alkaloid the sedative and anodyne properties of extract of lettuce are due.

That this important constituent has been until now overlooked is probably due to the fact that in chemical investigations upon lettuce the dried milk sap, lactucarium, has alone been examined, although its value as a sedative and anodyne is by no means established. The author found that lactucarium of both English and German manufacture was devoid of mydriatic properties and contained no alkaloid whatever.

The fact that lettuce contains a poisonous alkaloid is not of great importance in connection with its use as a vegetable, since it is only used for this purpose in the early stages of its growth, before the bitter milk has been produced, when the hyoscyamine is only present, if at all, in minute quantities. The amount of mydriatic alkaloid in the extract prepared from garden lettuce when in flower is not more than 0·02 per cent. Nevertheless, cases have been recorded in which the immoderate consumption of lettuce has led to unpleasant and even fatal results. Lettuce belongs to the natural order *Compositæ*. This is the first occasion on which hyoscyamine has been found in plants not belonging to the natural order *Solanaceæ*. (*By T. S. Dymond, from the Research Laboratory of the Pharmaceutical Society of Great Britain.*)

Tagetes erecta.

The flowers contain a crystallizable substance *quercetagetin*, having the composition $C^{27}H^{22}O^{16} + 4H^{2}O$; it is the yellow colouring matter; its reactions in alcoholic solution are the same as those of quercetin, but it differs from the latter in crystalline form and solubility in alcohol. (*Bull. Soc. Chim.* [27] xxviii., 337.)

Saussurea Lappa.

Schimmel & Co. in their Report (April, 1892) state that Kusht root yields one per cent. of a light yellow essential oil, which possesses a sp. gr. of 0·982, and a rotatory power of + 15° 20′ in a tube of 100 mm. It begins to boil at 275°, and about one-half goes over below 315°; then complete decomposition takes place, producing a very disagreeably-smelling vapour. When treated with soda, a part of the oil combines with it, and can be separated by acids. The root has a violet odour, but it does not seem to yield an odorous oil of that perfume. Messrs. Schimmel state that the odour of the oil resembles at first that of elecampane. After the volatilization of this odour, in about 24 hours, the violet odour develops, but not sufficiently strong to indicate that the oil could be of practical use.

Mr. McDonell, Conservator of Forests in Kashmir, reports that the plant grows as high as 9,000 to 10,000 feet. The dried root sells at Rs. 25 per maund. It is collected by villagers and paid for at Tehsils. The chief purchaser is a Bombay Chinaman.

CAMPANULACEÆ.

Lobeline.

The only active principle of *Lobelia inflata* has recently been investigated by Dr. H. Dresser.

Warm-blooded animals poisoned by means of lobeline succumb to respiratory paralysis, so it is to be included among the respiratory poisons. In dogs the physiological action of lobeline is first manifested by a paralysis of the voluntary movements and by a concomitant exaggeration of the reflexes. Later these effects are complicated by a paralysis of the motor nerves, analogous to that produced by curare. Through its paralyzing action on the cardiac branch of the pneumogastric, lobeline resembles in its action the nicotine group. In warm-blooded animals the influence of lobeline is found in a great exaltation of the respiratory activity. It produces an acceleration of the respiratory movement, which is more persistent when the pneumogastric nerves are intact than when they have been divided. Further, the amplitude of the respiratory movements is increased, and the power of the respiratory muscles appears to be also augmented. Under the influence of comparatively small doses of lobeline, the inhibitory influence of the pneumogastric on the heart, as well as its action on the bronchial muscles, is suppressed. The respiratory muscles appear to receive especial stimulation from the respiratory centre when the latter is under the influence of lobeline; as a result, the work accomplished by the heart and respiratory muscles is greatly augmented. In comparison with the other agents which stimulate the respiratory functions, lobeline possesses the advantage over hydrocyanic acid in its freedom from depressing action, while it surpasses aspidospermine in energy. It therefore seems evident that the employment of lobeline as an anti-asthmatic is substantiated by experimental facts, though the author has not made any clinical experiments and offers no suggestions as to the proper form of employment of this alkaloid. (*Archiv. für Experimentelle Pathologie und Pharmacologie*, 26 Band, Heft 3 und 4.)

H. Paschkis and A. Smita (*Akademie d. Wissen., Wien*, April 17, 1890, through *Chem. Zeit.*, 1890, 594) use the following method for preparing lobeline: The herb of *Lobelia inflata* is extracted with water, acidified with acetic acid, the extract partly evaporated, made alkaline and extracted with ether. An extract was taken up with water and being acid was made alkaline and shaken with ether. The ether was evaporated and the alkaloid obtained as a thick oil of a yellow colour. For purifying, the alkaloid was dissolved in ether, shaken with water acidulated with hydrochloric acid, then made alkaline and taken up with ether. This was repeated three times, the ethereal solution then dried with potassium hydrate, and the ether distilled in an atmosphere of hydrogen. The free alkaloid or the sulphate was suspended in 10 per cent. potassium hydrate solution and treated with 4 per cent. potassium permanganate, until the green colour disappeared only slowly. The mixture was then filtered, acidified with sulphuric acid, extracted with ether, this evaporated and residue recrystallized from water. This proved to be benzoic acid. (*Am. Journ. Pharm.*, July, 1890.)

PRIMULACEÆ.

Anagallis arvensis.

A. Schneegas (*Journ. Pharm. von Els. Lothr.*, 1891, 171) has separated from this plant two glucosides identical with those obtained from quillaia and senega. The plant is said to be used in Mexico as a substitute for soapwort.

SAPOTACEÆ.

Indian Gutta-percha.

The natural sources of supply of gutta-percha, and the possibility of their exhaustion, were referred to in the *Kew Reports*, 1876 (p. 23); 1887 (pp. 30, 31); and 1881 (pp. 38-45). A few trees, natives of the Indian peninsula, yield substances more or less similar to gutta-percha. One of these is *Dichopsis elliptica*, Dalz. (=*Bassia elliptica, Isonandra acuminata*).

The following note on this plant appeared in the *Report of the Royal Gardens, Kew*, 1881, p. 44 :—

"This tree appears to be common on the Malabar Coast, the forests of Coorg, the Wynaad, Travancore, &c. It grows to a height of 80 or 90 feet. A substance similar to the gutta-percha of commerce is procured by tapping, but the tree requires an interval of rest of some hours, or even of days, after frequent incision. In five or six hours upwards of 1¼ lbs. was collected from four or five incisions. The gum is hard and brittle at the ordinary temperature, but becomes sticky and viscid on the increase of heat. It is not found applicable to all the purposes for which gutta-percha is used, but 20 or 30 per cent. of it may be mixed with gutta-percha without destroying its qualities."

The same tree is referred to in Watt's *Dictionary of the Economic Products of India*, Vol. III., p. 102. In this, an extract taken from Drury's *Useful Plants of India*, suggests that the gum might be usefully utilised as a sub-aqueous cement or glue; or that, on account of its perfume when heated, it might possibly be rendered of some value to the pastille and incense makers. More recently this gum has been analysed by Mr. David Hooper, F.C.S., F.I.C., Quinologist to the Government of Madras, and the results are given in the *Annual Report of the Cinchona Plantations of Madras* for 1891, p. 18:—

"*Indian Gutta-percha.*—An abundance of gutta-percha milk has been yielded during the dry weather in the Wynád by the Panchotee tree (*Dichopsis elliptica*), and some planters have been asking for information on the subject, and inquiring whether it could be made into a commercial article. The milk has been known for some years to afford what was called Indian gutta-percha or Pala-gum, and has been used as an adulterant of Singapore gutta. General Cullen brought it to notice 35 years ago, and Dr. Cleghorn published a memorandum on the subject at the time. It was reported upon by experts in London, who found that it was unfit for water-proofing purposes, as its solution in coal-tar and turpentine dry up to such a brittle consistence that the fabric is useless. It could be used as a birdlime or cement, and keeps well under water as a cable insulator, especially if mixed with some genuine gutta. By boiling the milk of the Panchotee tree, a white mass separates, which can be kneaded by the fingers, but which becomes hard and brittle when cold. The brittle character of this substance, I find, is due to a large proportion of a crystalline substance found also in true gutta, and called crystalban or alban. Crystalban, according to Payen, occurs to the extent of 14 to 19 per cent. in the best kinds of gutta-percha, but I have extracted as much as 69·2 per cent. of crystalban from the dried secretion obtained from Wynád. The presence of a large quantity of crystals in this gum, of course, would interfere with its utility, but crystalban is easily removed by boiling alcohol, and the residue consists of a very good and pure gutta-percha. I cannot see why this process could not be used to purify the Indian gum and so obtain an article similar to the Malayan article."

A note on a gum from a closely allied plant (*Dichopsis obovata*, C. B. Clarke) received at Kew from Burma appeared in the *Kew Bulletin*, 1892, p. 215. (*Kew Bulletin*, Dec. 1892.)

STYRACEÆ.

The Varieties of Benzoin.

The source of the different varieties of gum benzoin known to commerce, and many points regarding the mode of preparation of the drug, are still, to a large extent, matters of conjecture. Some authorities, including Dr. Treub, the well-known director of the Buitenzorg botanical gardens, are of opinion that Penang and Palembang benzoin are yielded by the same tree, and that the difference in the appearance and in the yield of cinnamic acid of the two kinds is caused by differences in their mode of preparation. Mr. Holmes does not agree with this view, but inclines to the belief that the Sumatra and Palembang varieties are both produced by the same tree—styrax benzoin—and that the Penang gum is *sui generis*, probably the produce of the *Styrax subdenticulata*, Miq., which occurs in Western Sumatra. Hanbury offers no definite opinion on the subject, nor does Flückiger, in his last edition, just published, of the *Pharmacognosie*. Contributions to the elucidation of a subject upon which so much divergence of view exists among authorities are always welcome, and they become doubly valuable when they are the result of careful local examination. In London the druggists distinguish four varieties of benzoin, *viz.*—Siam, the costliest variety; Sumatra, which comes next in value; Penang, which is a comparatively recent addition to our Materia Medica, and Palembang, the kind mostly used by benzoic-acid manufacturers. Leaving Siam gum, which is obtained from the mainland of Asia, out of account altogether, it is evident that the nomenclature of the remaining three varieties is not only altogether fanciful, but actually calculated to mislead. In Penang itself no benzoin is produced, and the gum which is imported by way of that great emporium of the trade of the Dutch East Indies is almost entirely, if not wholly, collected in the island of Sumatra. Palembang gum also is the produce of the same island, Palembang being simply the chief settlement of the residency of the same name, in the south-eastern part of the island of Sumatra, where a great part of the benzoin of commerce is brought to market, and whence it is sent on to Singapore or Penang on its way to Europe. Sumatra, though it has been nominally under Dutch rule for over two centuries, still contains some of the least-known spots on earth, and the detailed account of the cultivation and collection of benzoin in one of the remoter districts of the island, which we owe to Mr. L. M. Vonck, a member of the Dutch-Indian Civil Service, stationed at Sekajöe, in Sumatra, and which is published in the last issue of the Journal of the Netherlands Society for the Advancement of Industry, is, therefore, an acceptable addition to our knowledge of the collection of this important drug and the manner in which it passes into commerce. Mr. Vonck does not refer to the gum, of which he speaks either as Palembang, Penang, or Sumatra benzoin, and it may, therefore, be taken for granted that those classifications are unfamiliar to him. The gum of which he writes, and which appears the only kind brought into commerce from south-eastern Sumatra, is evidently all obtained from one tree, and seems to correspond with the kinds known to our druggists as Penang and Palembang. So far as his evidence goes, therefore, it certainly favours Dr. Treub's opinion that there is no difference between the commercial source of Penang and Palembang benzoin. The benzoin-tree (*Styrax Benzoin*, or, in Malay, pohon Kemenjan, or Menjan) occurs, according to Mr. Vonck, in various portions of the high and low lands of the residency of Palembang. It grows up to an altitude of about 600 feet above sea-level, either in small clusters or sporadically between other trees. Formerly little attention appears to have been paid to benzoin-culture. At any rate, the standard writers on the products of the Dutch Indies only mention benzoin as being collected from wild-growing trees in the virgin forests of the Upper Blitie, on the Lalang and Toengkal rivers, and in the wilds of Batang Lakoh in the country of the Koeboes. But the easy nature of the culture, and the high prices which good benzoin realised in former years (from £6 to £8 10*s*. per picul), acted as strong incentives to the extension of the plantation. There are only a few parts of the residency of Palembang in which the benzoin-tree is either scarce or non-existent. In some other districts the tree is found wild, but its gum is never collected, nor is the tree cultivated systematically. The principal districts in which the benzoin-tree is systematically cultivated in gardens are the divisions of Iliran, Banjoeasin, and Moesi Ilir. In the Koeboe country, already referred to above, in the virgin forests of which the benzoin-tree was formerly of very common occurrence, it has now almost been extirpated. The tree flourishes in various kinds of soil, but experience shows a high, dry sandy soil, free from danger of inundation, to be most fitted for its propagation. On low-lying, rich, and clayey soil the tree grows up more rapidly, but its gum is then of such a poor quality that the cultivation yields little or no profit. On such a soil there is also danger of floods, which are fatal to the tree. Marshy or stony soil is altogether unsuited to the culture. The tree is propagated from the seed, which is of a reddish colour, almost round in shape, and of the size of a marble. It is enclosed in a green shell. When the would-be planter has gathered a sufficient quantity of the seeds, which are a favourite food of wild beasts of the forest, he plants them out in rows in the paddy-field, just before the paddy crop is put in the ground. Sometimes the young benzoin-shoots which have grown up around the parent stem are dug out and transplanted among the paddy. The object of the plantation on the paddy-field is to secure the necessary shade for the seedlings, which would be easily killed by the fierce sunlight. Two seeds are usually planted in one hole; if both come up, the weaker plant is generally destroyed. If the culture takes place by means of young shoots from the parent tree, these shoots, before planting, are stripped of their leaves, and placed in water in bunches of about twenty-five, being kept afloat between two bamboo sticks. When fresh leaves have grown upon the shoots, they are planted out in an oblique hole, which is left open for a time. The new benzoin-tree grows from the roots of the young shoot, after which the stem of the latter perishes. The natives appear to take no trouble whatever in weeding their benzoin plantations, and many of the plants are therefore suffocated by creepers and weeds. Only after a lapse of seven years the native returns to the spot where he planted his seeds or shoots for the purpose of gathering his first crop of juice. By that time the shoot has grown into a fine tree, branching and bearing leaves at the top only, and from 25 to 40 feet in height. When once the tapping of the tree has commenced, its growth is almost arrested, and the colour of its bark gradually changes from pale grey to brown. If the tree is left to grow wild, its height trebles or quadruples, some of the specimens in the virgin forest being over 250 feet high. The incisions made in the tree are almost triangular in form, and are made at regular intervals and on a systematic and invariable plan. A yellowish juice begins to exude from the incisions a week after they are made, but not until six weeks or two months after its appearance has it hardened sufficiently to admit of being collected. The tree becomes exhausted between its seventeenth and its nineteenth year, the drying-up process commencing at the lower part. The natives collect three different qualities of gum, classed according to the lightness of their colour and their freedom from bark and other impurities. A full-grown benzoin-tree yields from 1 to 3 catties ($=1\frac{1}{3}$ to 4 lbs.) every season, and its cultivation is a source of considerable affluence to its proprietor. In the Moesi Ilir District several proprietors own from 500 to 7,000 benzoin-trees each. During the recent years of low prices, however, the cultivation has been carried on with great want of care, and in some parts a garden of 2,000 trees now yields hardly as much gum as a garden of 500 trees did when, some years ago, the collection of gum was carefully attended to. Still, the benzoin-producing villages of Sumatra are among the most prosperous in the whole island. If, through carelessness, as sometimes happens, the collection of the gum from some trees is forgotten during the season, the gum, after some months, is found to have exuded in great lumps, which have become quite hard, and are covered with a dirty layer of black. These pieces are cut from the trees with an axe, and roughly rinsed in the nearest creek. Afterwards hot water is poured over this gum, which softens it and renders it fit for packing. Palembang is the trade centre for the district, and the Chinese merchants there are the principal, if not the only, buyers. They systematically adulterate the benzoin by the addition of inferior gum-resins, wood, or earth, and it is said that for many years not a single parcel of pure benzoin has been exported from Palembang. The average benzoin exports from Palembang are about 700 tons per annum. Mr. Vonck mentions that the gum exported from Padang on the west coast of Sumatra is more valuable than that brought into commerce from Palembang. This has sometimes been ascribed to its greater richness in cinnamic acid, but Mr. Vonck believes it to be due rather to the greater care which is bestowed upon its collection. As the Penang and Palembang gums are the least valuable on the London market, and their prices correspond most nearly to the figures given by Mr. Vonck as the local value of the gum, equalling from about 5*s*. to 40*s*. per cwt.; this may be taken as additional evidence in favour of the view that the Palembang and Penang varieties are identical, and that the gum known in London as "Sumatra" is the product of the western districts of Sumatra, and may possibly be obtained from a different tree. (*Chemist and Druggist*, Sept. 26, 1891.)

An interesting paper on the origin of Benzoin by Fritz Ludy appeared in *Archiv de Pharmacie*, 231-43, an abstract of which is contained in the *Pharm. Journ.*, April 29, 1893.

APOCYNACEÆ.

Rauwolfia serpentina, *Benth.*

Note on certain reactions of an alkaloid contained in the roots.

In the *Pharmacographia Indica*, Vol. II., p. 416, one of us described the proximate composition of the root of the *Rauwolfia serpentina*, Benth., and noted the presence of one or more alkaloidal principles. This communication deals chiefly with the colour reactions of an alkaloid which we have separated from the roots, and provisionally termed pseudobrucine.

The isolation of the alkaloid in a pure condition was attended with difficulty. In our first experiments, the pounded root was exhausted with boiling 80 per cent. alcohol, and the alcohol free extract treated with cold water acidulated with sulphuric acid, by which a large amount of dark resinous matter was separated. The aqueous acid solution was then precipitated with Mayer's reagent, but the precipitate on decomposition did not yield the alkaloid in a pure condition, owing to a certain amount of resinous matter being precipitated with the alkaloid by the reagent, and which was subsequently dissolved by the amylic alcohol employed to separate the alkaloid after its liberation from the mercury compound. Attempts were made to separate dissolved resinous matter from the aqueous acid solution of the alkaloid by agitation with amylic alcohol, but the sulphate of the alkaloid was freely soluble in this alcohol. In ether the alkaloid was only very slightly soluble. Ultimately, the pounded root was percolated with chloroform, the chloroform evaporated off, and the extract treated with water acidulated with sulphuric acid. The acid aqueous solution of the alkaloid was then agitated with chloroform, which separated some colouring matter and a trace of alkaloid. The chloroform was then separated and the acid solution made alkaline with sodic carbonate and reagitated with chloroform; this series of operations being repeated several times. The final chloroform extract was dried and agitated with ether, which removed traces of colouring matter. The extract now formed a cinnamon-coloured powder, extremely bitter, soluble in dilute acids, and dissolving in amylic alcohol or chloroform with a very marked greenish fluorescence. An alcoholic solution of the alkaloid did not crystallize, and we failed in obtaining distinctly crystalline salts. A solution of the alkaloid in dilute sulphuric acid afforded with alkaline carbonates and hydrates a bulky white precipitate; but even after repeated precipitation and re-solution, the physical characters of the alkaloid were not materially altered, and its solution in amylic alcohol or chloroform still showed a marked fluorescence. A solution of the alkaloid in dilute sulphuric acid, when agitated with animal charcoal, completely lost its bitterness, the solution being at the same time completely decolourized. The alkaloid could be again separated from the charcoal by treatment with warm alcohol, the physical characters being unaltered.

The following colour reactions were noted, pure brucine being tested at the same time as a control:—

Reagent.	Brucine.	Alkaloid suspected to be Brucine.
Conc. sulph. acid containing a trace of nitric acid.	Pink	Yellow.
Conc. hydroc. acid ...	Colourless	Yellow.
Acetic acid	Colourless	Yellow.
Conc. nitric acid ...	Scarlet, soon passing into yellow.	Scarlet, does not become yellow so soon as the brucine, but only after standing for some time.
Sulph. acid and bichromate of potash.	Yellow, with tinge of red ...	Slight purple, not unlike the strychnia reaction, but not so marked.
Sulph. acid and MnO^2.	Orange	Violet, changing to dark brown.
Chlorine	Red: colour soon discharged, decolourized by ammonia.	Red: colour not so soon discharged, decolourized by ammonia.
Mercurous nitrate, with slight excess of HNO^3.	Pink on warming, colour deepens on standing.	Yellow on warming, but no pink colour.
Mayer's reagent ...	Pale yellowish ppt., flocculent.	Pale yellowish ppt., flocculent.
Nitric acid and $SnCl^2$.	Purple, discharged by excess of both reagents.	No purple colour.
Sulphuric acid and potassium nitrate.	Red, changes soon into yellow.	Red, with greenish-purple tint at the edges; red colour deepens on standing.
Sulphocyanide of potassium.	White ppt., sol. in excess of acetic acid, repptd. by NaHO.	White ppt., sol. in excess of acetic acid, repptd. by NaHO.

Reagent.	Brucine.	Alkaloid suspected to be Brucine.
Bichromate of potassium in acetic acid solution.	Copious yellow ppt., with difficulty soluble in large excess of acetic acid.	Copious yellow ppt., with difficulty soluble in large excess of acetic acid.
Platinic chloride ...	Thick yellowish floc. ppt., with difficulty soluble in acetic acid, but with exception of a few flocks completely soluble in $NaHO$.	Thick yellowish floc. ppt., readily soluble in acetic acid, but almost insoluble in $NaHO$.
Auric chloride ...	Dirty white floc. ppt., soon changing to flesh colour, soluble in excess of acetic acid, but insol. in $NaHO$.	Beautiful purplish-red ppt., soon changing to dirty brown, with a green tinge, sol. in excess of acetic acid, but insol. in $NaHO$.
Potassium ferrocyanide.	Light yellow ppt., soluble in dilute H^2SO^4. The presence of acetic acid in slight excess prevents precipitation.	Light yellow ppt., sol. in dil. H^2SO^4. The presence of acetic acid in slight excess does not prevent precipitation.
Alcoholic solution of iodine.	Alcoholic solution of alkaloid, rosette crystals.	Alcoholic solution of alkaloid, no crystalline forms on microscopic examination.

Two experiments were made to determine whether the alkaloid possessed any physiological properties similar to brucine. In the first experiment ·15 gramme was dissolved in three drops of acetic acid diluted with about two drachms of water, and injected into a cat's stomach at 11-21 A.M.

11-37 A.M.—A quantity of half-digested food was vomited; there was a good deal of frothy mucus and constantly dribbling saliva, movement of the jaws, and application of the paws to the mouth as if to remove some irritant matter; the animal restless and much distressed.

12-30 P.M.—Frothy mucus and saliva still flowed from the mouth, but in smaller amount; vomiting ceased, but now and then retches; animal not so restless.

1 P.M.—Discharge of saliva ceased; animal quiet, no further symptoms developed.

In the next experiment ·022 gramme of the alkaloid was dissolved in acetic acid, the solution evaporated to dryness, the residue dissolved in a few drops of distilled water, and the solution hypodermically injected into the left hind leg of a small frog at 11-40 A.M.

The frog was placed under a large glass funnel and jumped about, a tap on the glass being sufficient to make it change its place.

11-44 A.M.—Frog showed no inclination to move; when its back was touched with a glass rod it made feeble attempts to move its limbs; some loss of power was evident, but there were no twitchings of the limbs or convulsive movements.

11-46 A.M.—The frog did not move its limbs even when tapped on the back; the left leg appeared quite paralysed.

11-50 A.M.—The limbs were quite lax, and might be placed in any position without the animal making any effort to move them. When placed on its back, it now and then made feeble attempts to move the right leg; then the movements stimulated slight twitchings. After this, and until its death at 12 noon, it lay motionless, the only sign of vitality being an occasional gasp; limbs flaccid, no convulsions. As a control experiment, another frog, a little larger, was injected with the same amount of brucine. Two minutes after the injection it was perfectly motionless; there was evidently loss of voluntary power over the limbs. When placed on its back and touched, it made no effort to move, but slight twitchings of the limbs were noticed, which became more marked in about a couple of minutes. Touching the back, pinching the limbs, or even gentle tapping on the table, was now sufficient to produce rather feeble convulsive movements, but there was no spasm, except when thus regularly induced. The frog died about ten minutes after the injection. After death the limbs were not stiff but rather flaccid.

Many of the reactions we have described as being afforded by the alkaloid we have provisionally termed pseudobrucine were identical with those yielded by brucine; while, on the other hand, certain reactions were quite different. The history of the drug shows that it is employed as a domestic remedy in the treatment of a large number of affections, but there is no evidence to indicate that it is supposed to possess any toxic properties. When we are satisfied that we have obtained the alkaloid in a pure state, its ultimate composition, &c., will be determined. (*C. J. H. Warden and Assistant Surgeon Chuni Lal Bose, Pharm. Journ.*, Aug., 1892.)

Oleander as a diuretic and heart-tonic.

F. v. Oefele (*Pharm. Pr.*, Oct. 24, 1891, pp. 2-5) draws attention to the action of this plant as a diuretic and heart-tonic in place of digitalis. He considers an infusion of the fruit to be preferable to all other preparations: the infusion may be preserved from deterioration by the addition of a little glycerine or spirit. Dr. von Oefele considers that a maximum dose of ⅔ of a gram of the raw drug or its equivalent in solution should not be exceeded in the 24 hours. (*Nouveaux Remèdes*, Jan. 24, 1892.)

Hunteria corymbosa, *Roxb.*, *Wight Ic.*, *tt.* 428, 1294; *Bedd. For. Fl. ii.*, *t.* 265.

The bark of this tree, a native of the Deccan Peninsula, Coromandel Coast, Tavoy, Penang, and Ceylon, has been shown by Greshoff (*Meded. uit S'lands Plant.*, vii., p. 55) to contain 0·3 per cent. of a crystalline alkaloid, which also forms crystalline salts, and gives a beautiful violet coloration with Erdmann's and Fröhde's reagents. It is a strong poison, and has a sharp, burning taste, even when diluted to 1: 10,000.

Vinca pusilla.

This plant is called Mulakapundu in Tamil, and the ryots of South Arcot say that if cattle graze upon it they become giddy and die. We have chemically examined this plant, and find that the poisonous property is due to an alkaloid named *Vincine*, which is distinguished by giving a carmine-red colour with pure nitric acid.

ASCLEPIADEÆ.

Gymnema sylvestre.

In doses of 0·3 to 0·4 gram, gymnemic acid acts as an emetic. In much smaller doses it is stated to be very effective for distinguishing the taste of bitter drugs. For this purpose a ½ per cent. aqueous solution containing a small addition of alcohol is used for rinsing the mouth immediately before taking the medicine.

The acid is obtained by moistening the powdered plant with a solution of caustic soda, allowing the moist mass to stand in a percolator for two days, and then extracting with benzin. After removing the benzin from the percolate by distillation, the residue thus left is repeatedly washed with ether and dried. The product forms a brownish crystalline powder, which is soluble in 100 parts of water, freely soluble in alcohol and insoluble in ether and chloroform. It is decomposed by acids. (*A. Quirini*, *Pharm. Zeitung*, 1891, 401.)

LOGANIACEÆ.

Strychnine in snake-bite.

An interesting illustration of the antagonistic action of poisons is given in a letter we have received from Mr. W. Rushton, addressed to his brother in Tasmania by Dr. Mueller, of Yackandandah, Victoria, in which he states that in cases of snake-bite he is using a solution of nitrate of strychnine in 240 parts of water mixed with a little glycerine. Twenty minims of this solution are injected in the usual manner of a hypodermic injection, and the frequency of repetition depends upon the symptoms being more or less threatening, say from 10 to 20 minutes. When all symptoms have disappeared, the first independent action of the strychnine is shown by slight muscular spasms, and then the injections must be discontinued unless after a time the snake-poison again reasserts itself. The quantity of strychnine required in some cases has amounted to a grain or more within a few hours. Both poisons are thoroughly antagonistic, and no hesitation need be felt in pushing the use of the drug to quantities that would be fatal in the absence of snake-poison. Out of about one hundred cases treated by this method, some of them at the point of death, there has been but one failure, and that arose from the injections being discontinued after one and a quarter grain of strychnine had been injected. Any part of the body will do for the injections, but Dr. Mueller is in the habit of making them in the neighbourhood of the bitten part or directly upon it. (*Pharm. Journ*, June 13, 1891.) These results are opposed to the experiments instituted by the Commission appointed in India to investigate the influence of artificial respiration, intravenous injection of ammonia, &c., in Indian and Australian snake-poisoning (1874). More recently, A. A. Kanthack (*Jr. Physiology*, Vol. XIII., Nos. 3 and 4, 1892) has shown that strychnine is neither a chemical nor physiological antidote of cobra-albumose; and he is of opinion that "no false hopes should be raised or fostered as to a cure by strychnia."

BORAGINEÆ.

The active principle of the Borageneæ.

Schlagdenhauffen and Reeb have examined the roots, stalks, leaves, and seeds of *Cynoglossum officinale* and *Heliotropium europæum*. Petroleum ether extracted from the roots a coloured substance analogous to alkanet red. By subsequent treatment with alcohol an alkaloid was obtained which the authors term *cynoglossine*. It is hygroscopic, combines with acids, forming uncrystallizable salts which are decomposed at 100° C. The base was also found in the seeds, but not in the leaves or stalks. Cynoglossine has a toxic action; injected hypodermically 0·001 to 0·002 gram caused violent convulsive movements in a frog, followed by death after several hours. 0·050 gram repeated several times caused nausea and vomiting in a pigeon and death without convulsions. In a rabbit weighing 3·500 kgs. a dose of about one gram produced narcotism and convulsive movements. (*Pharm. Post*, xxv., 1.)

We have received from Afghanistan, under the names of *Gaozaban* and *Gul-i-gaozaban*, the leaves and flowers of *Trichodesma molle*, DC.; and Aitchison (*Notes on Prod. of W. Afghanistan and N.-E Persia*, p. 12) records the collection of the corollas of *Anchusa italica*, Retz., to be employed as *Gul-i-gaozaban.*

SOLANACEÆ.

Lycopersicum esculentum, *Miller.*

The tomato fruit has been chemically examined by G. Briosi and T. Gigli. On an average the fresh fruit contains: Seeds 10·9 per cent., pulp 85·4 per cent., and skin 3·7 per cent. The pulp can be separated into a yellow juice and a red residue, which is tasteless after washing; the juice on an average has the specific gravity 1·0217, and contains levulose, citric acid (0·4 to 0·65 per cent. of the juice), albuminoids, and ash which is composed of 60 per cent. potassium salts. Minute traces of alkaloid are indicated; tartaric acid could not be detected. The red residue will impart its colouring matter to ether, alcohol, chloroform, and aqueous alkalies. The alcoholic solution is not changed by ferric chloride, dilute acids or lkalies; on addition of strong nitric acid a transient blue colour is produced; the residue on evaporating the alcoholic solution becomes blue by adding sulphuric acid; the colouring matter resembles that of saffron. (*Chemiker Ztg.*, 1891, 205.)

Mr. Frederick Davis has found that English-grown tomatoes subjected to distillation with water afford a volatile substance analogous to oil of onions or garlic. The crude oil obtained by distilling twenty-eight pounds consisted of oxide and sulphide of allyl. The crude oil was acted upon by metallic potassium to separate the oxygenated product, and the pure oil removed; this upon analysis proved to be represented by the formula $(C^3H^5)^2S$. (*Year-book of Pharmacy*, 1892, p. 515.)

Solanaceous Alkaloids.

The surprising statement made rather more than three years since, by Messrs. Schering, that belladonna roots contain practically only hyoscyamine, and that atropine obtained from them is probably a product of change occurring during the manufacture, suggested to Dr. Schütte to undertake a thorough investigation of the subject, and he has just published his results in a long and interesting paper (*Archiv*, Oct. 30, p. 492). In the first place the influence of methods of preparation upon the conversion of hyoscyamine into atropine was tested. Dr. Will had already stated that contact with an alkali is sufficient to effect this change, and Dr. Schütte found that the same result is produced by repeated recrystallizations from acidulated water, as well as by long keeping of hyoscyamine in solution or in the form of a gold salt. It was further ascertained that in fractional precipitation the gold salt of atropine, if any should be present, is thrown down before that of hyoscyamine, and the inference has been drawn that if any atropine gold salt be thrown down at the commencement of the precipitation in a properly-conducted experiment, it represents atropine existing as such in the plant-part, and that any obtained from a mother-liquor after the removal of the hyoscyamine represents a product of alteration. The influence of age and period of vegetation upon the alkaloids in the roots was next investigated. It was found that young fresh roots (1 to 2 years), collected from a basaltic district, whether gathered in the spring, summer or autumn, contained only hyoscyamine, but that older roots (8 years and upwards) always contained, besides much hyoscyamine, a little already-formed atropine. Similar results were obtained with roots from old cultivated plants and roots that had been kept several years. The amount of alkaloid was considerably greater in the roots collected in summer than in the spring roots, and fell off again in the autumn, but more rapidly in the old than in the young roots. The averages obtained at the three periods were for young roots 0·127, 0·452, and 0·458 per cent., and for old roots 0·174, 0·358, and 0·280 per cent. Spring and autumn leaves of the belladonna plant both contained principally hyoscyamine, with small quantities of ready-formed atropine. As to the fruit, the unripe berries of the wild plant contained chiefly hyoscyamine and a little atropine, but the ripe fruit contained only atropine. The ripe berries of cultivated plants, however, yielded both hyoscyamine and atropine, while the ripe berries from var. *lutea* gave atropine and a small quantity of a base probably identical with Hesse's atropamine. Turning to other Solanaceous plants, fresh and old stramonium seeds yielded chiefly hyoscyamine, together with small quantities of already-formed atropine, and scopolamine. The leaves of the potato plant (*Solanum tuberosum*), besides yielding betaine, gave indications of the presence of an alkaloid having a mydriatic action, which seemed also to resemble a mydriatic base present in *Solanum nigrum* and *Lycium barbarum*. The leaves of *Nicotiana tabacum* also yielded traces of a mydriatic alkaloid, and lastly the seed, herb, and root of *Anisodus luridus* all contained hyoscyamine only. (*Pharm. Journ.*, Nov. 28, 1891.)

Tobacco Smoke.

Tobacco-smoke varies in character according to the proportion of air admitted during combustion, oxidation being necessarily more perfect in the case of a cigar than when the tobacco is smoked in a pipe. In the latter case, a portion of the condensible products is deposited in the liquid state. Tobacco-smoke consists in part of permanent gases, the proportions of carbon dioxide and carbon monoxide in which have been determined by G. Krause. Vohl found sulphuretted hydrogen and hydrocyanic acid, and from 0·7 to 2·8 grammes of ammonia for 100 of tobacco smoked. Vohl and Eulenberg (*Arch. Pharm.*, [2], cxlvi., 130) experimented on the smoke of strong tobacco, burnt both in pipes and in the form of cigars. The smoke was first aspirated through a solution of caustic potash, and then through dilute sulphuric acid. The alkali absorbed carbon dioxide, sulphuretted hydrogen, hydrocyanic, formic, acetic, proponic, butyric and valeric acids, phenol and creosote; the presence of caproic, caprilic and succinic acids could not be ascertained conclusively. The acid absorbed ammonia, pyridine, C^5H^5N, and all the homologues of the series to viridine, $C^{12}H^{19}N$, inclusive. In addition to the above, carbon monoxide, methane, and several hydrocarbons of the acetylene series were detected. Pyridine was the chief base in the smoke from pipes, while collidine was the prominent base in cigar-smoke. Vohl and Eulenberg conclude that the nicotine of tobacco is completely decomposed during the process of smoking, and that the intense action of tobacco-smoke on the nervous system is due to the presence of bases of the pyridine series. There is no doubt that some observers have mistaken these bases for nicotine; but Melsen's experiments (*Dingl. Polyt. Jour.*, xlvii., 212) appear to be conclusive as to the presence of nicotine, which that chemist isolated in a condition fit for analysis, and to the amount of about 3·3 grammes for 4½ kilogrammes of tobacco smoked, or about one-seventh of the quantity originally present. (*Allen's Com. Organ. Anal.*, iii., pt. 2.) A. Gautier has since observed that the volatile liquid products formed when tobacco is smoked in a pipe consist chiefly of basic compounds. They contain a large proportion of nicotine, a higher homologue of nicotine $C^{11}H^{16}N^2$, which pre-exists in tobacco leaves, and a base C^6H^9NO, which seems to be a hydrate of picoline. Other less volatile bases, including hydropyridines, are also formed. These alkaloids result from the decomposition, at a comparatively low temperature, of the carbopyridic and carbohydropyridic or analogous acids present in tobacco. (*J. Chem. Soc.*, April, 1893.)

The alkaloidal contents of the Seeds and Tincture of Datura Stramonium.

The principal constituents of stramonium seeds, according to Flückiger and Hanbury's *Pharmacographia* (p. 461), are an alkaloid, existing in combination with malic acid, and a fixed oil, of which the seeds are said to contain 25 per cent. The alkaloidal constituent was first isolated by Geiger and Hesse in 1833, and in 1850 was submitted to examination by Von Planta, who came to the conclusion that it was identical with atropine. This statement was subsequently confirmed by E. Schmidt (*Ber. der Deutsch. Chem. Ges.*, xiii., 370), who, however, afterwards modified his views, and concluded that daturine was really a mixture, in varying proportions, of atropine and hyoscyamine (*Archiv. der Pharmacie*, xxii., 329).

Ladenburg also showed (*Berichte Chem. Ges.*, xiii., 909) that stramonium contains two alkaloids, which he designated heavy and light daturine, the former consisting of atropine and hyoscyamine, and the latter of hyoscyamine only.

As to the distribution of the alkaloid in the plant, and the comparative strength of the seeds and the leaves, very little reliable information is obtainable.

Hurtz and Hopp (*Annal der Therap.*, 1862, p. 22) inferred, from experiments made by them, that an extract from the seeds possessed five times the physiological activity of an extract from the leaves. Evidence of this kind is, however, of very little value unless the proportionate amount of extract obtained from the seeds and the leaves is stated, as the yield varies within wide limits. The alkaloidal content of the seeds is given in *Pharmacographia* as ·1 per cent. and that of the leaves as ·02 to ·03 per cent.

Hurtz (*Druggists' Circular*, Aug., 1884) reports having obtained a yield of daturine from the seeds of ·167 per cent.

E. Schmidt (*Year-book of Pharmacy*, 1885, p. 242) obtained from 5 kilos of each of four specimens of seeds, 12·5, 18·4, 2·6, and 10·2 grams alkaloid, equivalent to a percentage yield of ·25, ·37 ·05, and ·20 respectively.

A. B. Lyons (*Manual of Practical Assaying*), estimating the alkaloid by titration with Mayer's solution, found the average yield of alkaloid by five specimens of the seeds to be from ·45 to ·55 per cent., and that from eight specimens of the leaves to be ·40 to 25 per cent.

If these results could be trusted, they would appear to indicate that the percentage of alkaloid in the seeds and leaves is practically the same, but the process of estimation by titration with Mayer's solution almost invariably gives results which are too high, and a systematic examination of a number of samples of the seeds and leaves, with a view of ascertaining their relative alkaloidal strength, is still needed.

For the purpose of our experiments, eleven specimens of stramonium seeds were obtained, and a series of tinctures made from each, by the B. P. process, with menstrua of 80, 70, 60, 50, and 40 per cent. strength (by volume). It was remarked that all the tinctures became opalescent when kept, and all threw down a more or less abundant deposit. The latter varied greatly in appearance, that from the 80 and 70 per cent. tinctures apparently consisting of fatty matter in a semi-transparent crystalline condition, while the deposit from the tinctures of lower alcoholic strength was darker in colour and appeared to partake more of a resinous character.

In addition to the seed tinctures, we also prepared, for the purpose of comparison, three series of tinctures from the leaves, menstrua of the same alcoholic strength, and the same proportion of drug to menstruum being used, as in the case of the seed tinctures.

Before proceeding to the quantitative estimation of the alkaloid, a few preliminary experiments were tried, in order to ascertain whether the process employed for the estimation of the alkaloid in tinctures of henbane and belladonna was equally well adapted for the estimation of the stramonium tinctures.

For this purpose 300 c.c. of a standard tincture was prepared with a 60 per cent. menstruum, and the alkaloid estimated by the following processes, the usual precautions being taken to prevent loss of alkaloid in washing with chloroform, &c.:—

Experiment I.—Fifty c.c. of the tincture was evaporated to low bulk with addition of water, until all spirit had been removed. The residual liquor was allowed to cool and was then acidified with dilute sulphuric acid, and freed from fat and colouring matter by means of chloroform. It was then made alkaline, and the alkaloids removed by shaking with three successive portions of chloroform. From the mixed chloroformic solutions the alkaloids were extracted by three agitations with acidulated water, and were afterwards regenerated from the mixed acid solutions, after addition of excess of ammonia, by shaking out with chloroform. The latter solution was then shaken with ammoniated water, and after separation was drawn off and evaporated, and the residue dried at 100° and weighed.

Experiment II.—The tincture was evaporated to low bulk, the residual liquor allowed to cool, and an excess of dilute sulphuric acid added. It was then freed from fat and colouring matter by means of chloroform, a slight excess of ammonia added, the alkaloids shaken out with three doses of chloroform, the latter solutions mixed, and after treatment with ammoniated water evaporated, and the residue dried and weighed.

Experiment III.—The tincture was evaporated till all spirit was removed, and the residual liquor acidified with dilute sulphuric acid and shaken with chloroform and ether in turn, till the latter came away colourless. The alkaloidal solution was then made alkaline with ammonia, the alkaloids shaken out with three successive 15 c.c.

ether (sp. gr. ·717), the mixed ethereal solutions evaporated, and the residue dried and weighed.

Experiment IV.—The tincture was evaporated to remove the spirit, the residual liquor acidified, and colouring matter removed by means of chloroform. It was then made alkaline and the alkaloids extracted with chloroform. From the chloroformic solution the alkaloids were removed by agitation with acidulated water, the latter solution treated with a slight excess of ammonia; the alkaline liquid shaken with three successive portions of ether (sp. gr. ·717), and the mixed ethereal solutions evaporated, and the residue dried at 100°, and weighed.

Experiment V.—This was conducted exactly as No. II., the oil being removed by means of petroleum ether before the preliminary treatment with chloroform.

The results were as follows:—

Experiment I. 50 c.c. tincture = ·014 gram alkaloids.
Experiment II. 50 c.c. „ = ·015 „
Experiment III. 50 c.c. „ = ·012 „
Experiment IV. 50 c.c. „ = ·010 „
Experiment V. 50 c.c. „ = ·014 „

These results indicated that the method of extraction by means of chloroform was thoroughly reliable, notwithstanding the presence of fixed oil in the tincture, and also showed that the preliminary treatment with petroleum ether, in order to remove the oily matter, was unnecessary. Confirmatory experiments with a 70 per cent. tincture, by processes II. and V., gave the following results:—

No. II. 50 c.c. tincture = ·015 gram alkaloids.
No. V. 50 c.c. „ = ·014 „

The exact details of the process adopted are as follows:—

Fifty c.c. of the tincture to be estimated is introduced into a porcelain dish, and evaporated over a water-bath to low bulk; water being added, if necessary, until all the spirit is removed. The residual liquor is allowed to cool, and is then acidified by the addition of 1 c.c. semi-normal sulphuric acid, and the liquid filtered through cotton wool into a separating funnel. The dish and filter are rinsed first with a little acidulated water and then with 15 c.c. chloroform, the rinsings added to the contents of the funnel and the whole well shaken. After separation the chloroform is drawn off, and the process repeated with 10 c.c. chloroform. The washings are mixed and freed from traces of alkaloid by shaking with three successive small portions of acidulated water, and these are separated and added to the original solution. The latter is then made alkaline with ammonia, and the alkaloids extracted with three successive 15 c.c. chloroform. To obtain the alkaloids in a pure condition, they are withdrawn from solution in chloroform by agitation with three successive small portions of acidulated water, the mixed acid solutions made alkaline with ammonia, and the alkaloids taken out by agitation first with 10 c.c. and then with two successive 5 c.c. chloroform. In cases where the final acidified aqueous solution was not colourless, the process of shaking out was repeated. The mixed chloroformic alkaloidal solutions were afterwards shaken with ammoniated water, and after separation were drawn off and evaporated over a water-bath, and the alkaloidal residue heated at 100° until the weight was constant.

The above process was found to be applicable to the majority of the tinctures without any modification; but with others greater difficulty was experienced than had been the case in any of the estimations previously made.

This arises from the fact that in many specimens of stramonium seeds there seems to exist some substance soluble both in alcohol and water, and not removable by chloroform either from an acid or alkaline liquor, and which possesses the property of emulsifying chloroform when that liquid is shaken up with a solution containing it.

No difficulty was experienced in removing the oil and colouring matter, but when the extract was made alkaline and shaken with chloroform, emulsification took place, and the chloroform refused to separate out clear, even after standing for some hours. Separation into two layers did, however, take place, the upper layer consisting of a brown alkaline mother-liquor, and the lower layer of emulsified chloroform containing the alkaloid in solution, and holding in suspension some of the mother-liquor. It was ascertained that all the alkaloid was taken out by the chloroform, and two processes were devised, whereby it could be extracted from the chloroform emulsion and obtained in a pure condition. By the plan first adopted, the original alkaline liquor was shaken with three successive 15 c.c. chloroform, and after separation these were drawn off in turn and mixed. The mixed chloroformic solutions were then shaken up with four successive small portions of acidulated water, by which means all the alkaloid was taken out, together with the mother-liquor included in the chloroform magma, and the latter separated out clear. The acid solutions were mixed and made alkaline, and the alkaloids again shaken out with three successive portions of chloroform. The latter were drawn off and mixed and the process repeated (usually five or six times) until a point was reached where the alkaloidal solution became almost colourless, and a perfectly clear chloroformic solution was obtained. When this point had been attained, the alkaloids were once more extracted with acidulated water, the latter solution made alkaline, the alkaloids again taken out with chloroform, the chloroformic solution shaken with ammoniated water, and after separation drawn off and evaporated and the residue dried at 100° and weighed. The loss of alkaloid by this process is very slight, and there is no waste of chloroform, the same portion being employed all the way through for shaking out the alkaloids, a fresh quantity being used only for the final extraction of the pure alkaloid. The process, however, was a very long and tedious one, each estimation occupying four or five hours.

The following modification was found to give reliable results, and to shorten materially the time occupied by each estimation:—

The chloroform magma is introduced into a separating funnel and shaken vigorously, when, as a rule, about half the chloroform separates out and can be run off. To the remaining emulsion 5 c.c. of 90 per cent. alcohol is added and the whole well shaken and then allowed to stand, when a perfect separation into two layers takes place, the lower layer consisting of chloroform and alcohol, and the upper layer of a brown alkaline aqueous liquid. The whole of the alkaloid is taken out by the chloroform. The latter is drawn off and added to the portion previously separated and the alkaloid extracted by shaking with three portions of acidulated water. The acid solutions are mixed and made alkaline and the alkaloids recovered by means of chloroform. This process is once repeated, and the final chloroformic solution, after shaking with ammoniated water, is drawn off and evaporated, and the residue dried at 100° and weighed. These two modifications of the process of estimation were tried side by side on four of the most troublesome samples of tincture, and the results in each case were exactly concordant.

The alkaloid as obtained by either of these processes is in the form of a perfectly colourless, transparent fused mass. It is soluble in water and dilute acids, and the reactions generally correspond with those of the alkaloidal residue obtained from the belladonna tinctures.

A glance at the table will show that the most perfect exhaustion of stramonium seeds is effected by the use of a 60 or 70 per cent. menstruum, the average yield of alkaloid by the tinctures prepared with menstrua of these strengths being equal. It is open to question, however, whether a better preparation could not be obtained from the leaves. The chief objections to the tincture prepared from the seeds are that it almost invariably becomes turbid and deposits when kept, and also becomes opaque on dilution, which objections do not apply to a 50 per cent. tincture of the leaves.

The results of the examination of the leaf-tinctures are appended to the table. The leaves from which No. 1 series was prepared were gathered from plants grown by one of us (Farr), and the deficiency of alkaloid is doubtless accounted for by the persistent rain and lack of sunshine which characterized the past season. The tinctures made from the other two specimens, however, gave the same average of alkaloid as the seed-tinctures. Lyons' results, referred to above, go to show that the alkaloidal strength of the seeds and leaves is the same, and should this fact be established as the result of further work upon the subject, we should recommend that this tincture, like those of henbane and belladonna, be prepared from the leaves, on the ground that a 50 per cent. tincture of the leaves is a more elegant pharmaceutical product than a 60 per cent. tincture of the seeds.

The results tabulated go to prove that the alkaloidal content of stramonium seeds does not vary to anything like the same extent as does that of most other drugs, the yield of the tinctures varying between the limits of ·020 and ·034, with an average of ·026 per cent.

This tincture, like those of henbane and belladonna, readily admits of standardization, and the standard should be fixed not lower than ·025 per cent.

The average amount of alkaloid contained in the seeds, calculated upon the basis of our results, is about ·2 per cent.

The percentage amount of the extractive in tinctures was ascertained by evaporating 10 c.c. of the sample over a water-bath, heating the residue at 100° till the weight was constant, and multiplying the result by ten.

It will be remarked that the last five series of tinctures show a much higher yield of extract than the first six, and it will also be noticed that the difference is more marked in the case of the tinctures prepared with the stronger menstrua. This discrepancy is accounted for by the fact that series 1—6 were made, as the Pharmacopœia directs, from the bruised seeds, while the drugs employed in the preparation of series 7—11 were reduced to somewhat fine powder before being converted into tincture. We have previously pointed out, in connection with the tinctures of conium and colchicum, that it is not advisable to reduce the drug to a fine state of disintegration. The sole result, in the case of stramonium seeds, is to expose the oily albumen to the free action of the menstruum, and as a consequence to load the tinctures prepared with the stronger menstrua with a quantity of oily and in all probability inert matter. This is proved (as was the case with tincture of colchicum) by the remarkable variation in the yield of extractive, by the tinctures of higher and those of lower alcoholic strength. As a general rule, the weaker the menstruum, the greater the percentage of extractive in the resulting tincture, but in the case of seed-tinctures this rule is reversed.

Table showing Quantitative Results of Estimation of Samples of Tincture of Stramonium Seeds.

No. of Sample.	Amount of alkaloid in grams from 100 c.c. tincture.					Amount of extractive in grams from 100 c.c. tincture.				
	80 p. c. tincture.	70 p. c. tincture.	60 p. c. tincture.	50 p. c. tincture.	40 p. c. tincture.	80 p. c. tincture.	70 p. c. tincture.	60 p. c. tincture.	50 p. c. tincture.	40 p. c tincture.
1	·030	·034	·032	·030	·030	·52	·54	·54	·60	·61
2	·024	·026	·026	·024	·022	·52	·50	·56	·56	·55
*3	·021	·024	·023	·024	·017	·46	·51	·52	·52	·60
4	·030	·028	·027	·030	·029	·48	·58	·54	·52	·50
5	·028	·029	·028	·028	·026	·59	·61	·64	·78	·70
6	·020	·024	·025	·024	·018	·72	·74	·74	·78	·80
7	·026	·027	·0295	·023	·021	2·50	1·02	1·18	·74	·74
8	·021	·025	·0245	·019	·0205	1·76	1·16	1·24	·90	·70
9	·018	·019	·020	·015	·014	1·44	1·26	·92	·62	·52
10	·020	.023	·024	·021	·015	1·00	·96	·78	·68	·60
11	·021	·025	·023	·020	·018	1·34	1·14	·88	·74	·58
Average	·0235	·0258	·0256	·0234	·0209	1·02	·90	·77	·67	·64

Results of Estimation of Leaf-tinctures.

1	·012	·015	·014	·014	·013	1·60	2·08	2·20	2·46	2·34
2	·024	·028	·028	·028	·028	2·04	2·48	2·68	2·80	2·82
3	·022	·022	·023	·022	·022	1·90	2·04	2·08	2·94	3·08

* Series No. 3 was made from seeds gathered in 1889.

(*By E. H. Farr and R. Wright, " Pharm. Journ.," Jan.* 16*th*, 1892.)

ACANTHACEÆ.

Note on the presence of a Cholesterol in the roots of Hygrophila spinosa.

In the *Pharmacographia Indica*, one of us described the physical properties of a principle isolated from the roots of the *Hygrophila spinosa*, which was not unlike a cholesterol. Subsequently, through the kindness of Dr. Dymock, we obtained a large supply of the roots, and were able to separate a sufficient amount of the material to admit of its thorough purification and ultimate composition being determined.

For ultimate analysis the principle was crystallized from light petroleum ether, and the combustion made in an open tube in a current of oxygen. The tube had been in use some time and was in very good working order. The results obtained led to the following formula:—

		Calculated for $C^{26}H^{44}O$.	Found.
C^{26}	312	83·86	83·80
H^{44}	44	11·82	12·02
O	16	4·32	4·18
	372	100·00	100·00

At 175° C. (uncor.) the cholesterol commenced to soften, and melted at 184° (uncor.). The fusing point would appear to be higher than that of any cholesterol hitherto isolated. We were unfortunately unable to determine the specific rotatory power.

In purifying the cholesterol an alcoholic extract of the root was dried and exhausted with ether. The dry ether extract was treated with dilute sulphuric acid, and the insoluble residue taken up by ether. The ether extract was next boiled with aqueous caustic potash, the solution evaporated to dryness, and extracted with petroleum ether. The petroleum ether extract was boiled for some hours with alcoholic potash, the solution evaporated to dryness, and extracted with petroleum ether. The petroleum extract was of a yellow colour, and in order to decolourize it, it was dissolved in absolute alcohol, and the solution agitated with purified animal charcoal; this, however, failed to remove the whole of the colour, and the following experiment was adopted. The alcohol was evaporated off, the residue dissolved in petroleum ether, and the solution agitated with proof spirit; by this means most of the colouring matter was removed. The cholesterol was finally several times crystallized from petroleum ether, and was obtained perfectly white. A benzoyl derivative was also prepared. Evaporated with a drop of nitric acid and the dry residue moistened with ammonia, an orange colour developed, but no change was induced by the addition of caustic potash. The violet reaction with ferric chloride and HCl applied as described by Forti was very marked. The sulphuric acid and chloroform reaction was conducted in a stoppered bottle; the chloroform layer at first became yellowish-brown, then blood-red, finally darkening to reddish-purple; the sulphuric acid and stratum was of a pink colour, and in some experiments fluoresced. *(By C. J. H. Warden, and Assistant Surgeon C. L. Bose, Assistant Chemical Examiner to Government of Bengal.)*

LABIATÆ.

Salvia macrosiphon, *Boiss.*

The Kanocha seeds referred by us (Vol. III., p. 265) to *Phyllanthus madraspatensis* have been shown by Dr. O. Stapt to belong to a species of Salvia. Dr. Stapt bought the drug in the bazaars of Ispahan, where it was known by the Persian name Marv. A drug called "Merw" was mentioned by Abu Mansur in 1055, and Seligmann refers it to *Origanum Marv*, L., a native of Syria. Aitchison, in his *Notes on the Products of Western Afghanistan*, mentions "Salvia (?)" as the origin of the nutlets known as *Kanoucha* or *Kanouncha*. (*Pharm. Journ.*, March. 11, 1893.)

Influence of Menthol on the gastric functions.*

Following Professor I. T. Tchüdnovsky's suggestion, Dr. Vladimirsky has carried out a set of experiments on seven healthy subjects (six men, including himself, and one woman), aged from 24 to 32, the drug being administered with food, in the dose of 0·3, 1·0 and 20 grammes. The author has arrived at the following conclusions :—

(1) The drug (in any of the doses stated) very markedly diminishes the proportion of free hydrochloric acid in the gastric juice, the decrease attaining its maximum in about 1 or 1½ hours after the ingestion.

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* *St. Petersburg Inaugural Dissertation*, 1891, No. 77, p. 44; *Medical Chronicle*, August, p. 367.

(2) In persons presenting a more or less weakened motor power of the stomach, the decrease lasts longer than in those with a normal one.

(3) The digestive power of the gastric juice is diminished.

(4) The transformation of proteids into peptones is retarded (hence an increased proportion of propeptones, *i.e.*, intermediary products of peptonisation).

(5) The proportion of lactic acid in the gastric juice is augmented, the rise proceeding parallelly with diminution in the proportion of free hydrochloric acid.

(6) The motor power of the stomach grows weaker (in about one hour after the ingestion); in initial stages of the digestion, however, it may occasionally undergo some increase.

(7) The absorptive power of the organ improves, which seems to be dependent upon a favourable (stimulating) influence of menthol on the circulation.

(8) Contrary to the statements of Ossendowski (*vide* the *Journal of Laryngology and Rhynology*, May, 1890, p. 202), L. Braddon, M. Reichert, S. Rosenberg, Hugo Koster, and many other observers, menthol does not appear to possess any special "appetite-making" power.

(9) In 1 and 2 gramme doses, the remedy gives rise to a kind of intoxication, followed, in 4 or 5 hours, by sensations of languor and drowsiness.

(10) Menthol may prove useful as a substitute for camphor. (*By Nikolai A. Vladimirsky.*)

Ustukhadus and Gul-i-sirwaj.

We have received from Afghanistan, under the name of *Ustukhudus* (Stæchas), the flowering tops of a labiate plant which appears to be a *Moluccella*; it has enlarged purple calices and Balm-like odour.

In the same parcel we received, under the name of *Gul-i-sirwaj*, the large rose-coloured calices of *Hymenocrater elegans*, Bunge, containing the ripe nutlets; the calices have an agreeable aromatic odour and are mucilaginous.

ARISTOLOCHIACEÆ.

Aristolochine and Aristin.

These two substances have been obtained from the roots of *Aristolochia argentina* by Dr. O. Hesse, who gives the following account of them (*Pharm. Journ.*, Jan. 9th, 1892):—

The powdered root gives a dark brown yellow colour to ether, and when gaseous ammonia is added to the ethereal solution a red flocculent precipitate is separated. The ether solution separated from this precipitate gives on evaporation a yellowish-brown residue, in which clear, colourless crystals are formed after some time. The dark-coloured mass separated from these crystals and again dissolved in ether gives, on shaking with dilute sulphuric acid, a small quantity of a base. The greater part of it, however, remains in the root that has been treated with ether, and can be extracted with alcohol. On evaporating the alcoholic extract a brownish-yellow resinous residue is obtained that is partly dissolved by caustic soda solution and gives up the base to ether.

I propose to apply the name Aristin to the substance contained in the above-mentioned red ammoniacal compound. When that compound is dissolved in hot glacial acetic acid, the aristin crystallizes out on cooling, and it can easily be obtained in a pure state by recrystallizing from hot glacial acetic acid. Aristin forms shining gold-coloured laminæ and flat needles sparingly soluble in hot glacial acetic acid and scarcely at all soluble in the cold. It is sparingly soluble in hot alcohol, more so in ether, chloroform, or benzene.

At about 260° C. it blackens, but does not melt until the temperature reaches 270° C., and then undergoes decomposition. It dissolves in concentrated nitric acid on boiling for a short time, and separates again unaltered on cooling; but when the boiling is long continued decomposition takes place with evolution of red vapour. Aristin dissolves in acetic anhydride with a yellow colour, and when concentrated sulphuric acid is dropped into the solution it becomes at first intensely blue and then permanently greenish-blue. The alcoholic solution of aristin has a perfectly neutral reaction, but the substance combines with ammonia and with soda. These compounds have a fine red colour, and the ammonia compound can be crystallized from alcohol in delicate needles. Both compounds are dissolved by water or alcohol with deep orange-red coloration. On addition of acids to these solutions a flocculent yellow precipitate is thrown down which soon becomes crystalline.

The second of the above-mentioned compounds is a fat acid ester that can be easily purified by recrystallization from alcohol. It takes the form of small white laminæ which melt at 84° C., and are very soluble in hot alcohol, but sparingly in cold alcohol, very soluble in ether, pertroleum spirit or chloroform, and insoluble in water.

The substance dissolves in hot glacial acetic acid, and on cooling crystallizes out again unaltered. In the alcoholic solution this substance can be easily saponified, the products being phytosterin and palmitic acid.

The third substance mentioned above is a base, to which I propose giving the name Aristolochine. That name has already been applied by Chevallier to a bitter substance obtained from *Aristolochia serpentaria*, but it was obviously a mixture the bitter taste of which was probably due to the presence of the base now described. Therefore, the name seems to me to have been inappropriate in that instance, and I have transferred it to the pure substance.

Aristolochine is precipitated from its colourless solutions in sulphuric or acetic acid on the addition of ammonia or caustic soda in the form of white amorphous flocks. It is freely soluble in alcohol, ether, chloroform, or benzene. On evaporating the ether solution it remains as a colourless resinous mass. When the ether solution is mixed with an equal volume of petroleum spirit and the mixture very slowly evaporated, warty masses are deposited that are distinctly crystalline. The base has a bitter taste and neutralizes acid perfectly. The hydiodide and sulphocyanide are amorphous oily precipitates which present no tendency to crystallize. The platinochloride is a dark yellow and the aurochloride a pale yellow amorphous precipitate; both are almost insoluble in water.

The behaviour of the base with concentrated sulphuric acid is remarkable. It forms a fine green solution, which becomes bright bluish-green on the addition of a trace of ferric chloride. Similar reactions are given by aricine, cusconine, and some of the bases of the bark of *Remijia purdieana*.

Aristolochine appears to have been already observed by Dymock and Warden in their examination of *Aristolochia indica*, and I am of opinion that the differences of their statements in regard to the base are solely due to their having failed to separate it completely from colouring material. I am also of opinion that aristin partakes of the nature of the yellow substance* obtained by previous observers, and that, according to some remarks of Dymock and Warden, it is probably present in the root of *Aristolochia indica.*

Aristolochin is the name given by Dr. J. Pohl to the active principle of the seeds of *Aristolochia Clematitis* and the roots of *A. rotunda* and *A. longa.* The powdered drugs were exhausted with petroleum-ether, which removed chlorophyll, oil, and a gelatinous, nitrogenous, inactive substance (occasionally this can be obtained crystalline); warm 96 per cent. alcohol removed the colouring and bitter principles; after evaporating to syrupy consistence it was taken up with water and acidulated with sulphuric acid, the precipitate collected, expressed, dried at 40° C., and extracted in a Soxhlet apparatus for some weeks with petroleum-ether until the last traces of the above-mentioned nitrogenous substance were removed and the residue exhausted with alcohol or ether; from this alcoholic or ethereal solution there separated after a time yellow crystalline masses, which, recrystallized several times from ethereal solution, were found to constitute the active principle. It is soluble in chloroform, ether, acetone, phenol, acetic anhydride, aniline, and alcohol; almost insoluble in cold water, slightly soluble in warm water; insoluble in pertroleum-ether, benzol, and carbon disulphide; alkalies and alkaline-earth hydrates dissolve it; from neutral or alkaline solutions it is precipitated by neutral and basic lead acetate, dialyzed iron, zinc sulphate, silver nitrate, and a saturated solution of salt, but not by alum, copper sulphate, and platinic chloride; it does not reduce Fehling's solution and does not react with Millon's reagent. Its ultimate analysis, C 59·98, H 3·54, N 4·32, O 32·16, leads to the formula $C^{32}H^{22}N^{2}O^{13}$. Physiologically it was found that cold-blooded animals were entirely indifferent to it; while in warm-blooded animals uræmic intoxication was produced; in this respect aristolochin is a much more powerful agent than any other substance; it resembles aloin in its action upon the kidneys, but is about ten times more poisonous—it is probable that given to man it may act as a cathartic (*Arch. f. exper. Pathol. u. Pharm.*). (*Apoth. Ztg.* 1891, 642.)

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* See *Pharm. Journ.*, li., 245.

LAURINEÆ.

Gum-barks.

Gum-bark, or *Pishin-puttai* of the Tamils, does not refer to the bark of a tree which exudes a gum by bruising or incision, but denotes a bark which has such mucilaginous properties that it could be used for special purposes in medicine and the arts, where the white of egg would be used elsewhere. Barks of this description occur in the natural orders Malvaceæ and Laurineæ, and students of materia medica know that drugs of these orders, marsh-mallow root, and the barks of arboreous cinnamons, for instance, contain a peculiar mucilage, which is not precipitated by alcohol. A typical gum-bark of the East is that of *Kydia calycina*, a malvaceous tree, growing extensively on the slopes of the Nilgiris, and largely employed in sugar refinery under the Tamil name of *Kadularangy-puttai*. On soaking a portion of this dried bark in water it rapidly swells, and the inside becomes coated with a slimy mucilage. The inner layers of the liber may then be removed like pieces of lace, and the gum is seen to be occupying the spaces between the longitudinally disposed fibres, apparently formed from the cellulose of the broken cell-walls. The bark of Kydia is sold in the bazaars, and the decoction is taken as an astringent and tonic, and the Vythians or native doctors consider it to be a specific for diabetes.

Dr. Mohideen Sheriff, in the "Supplement to the Pharmacopœia of India," gives *Tetranthera Roxburghii* as the botanical origin of *Pishin-puttai*, but offers no description of the drug under that heading. Mr. Hollingsworth, of the Madras Medical College, some time ago supplied me with an authentic specimen of the bark of *Tetranthera laurifolia*, or, as it is now called in the "Flora of British India," *Litsœa sebifera*. The bark was of a reddish-brown colour and slightly balsamic odour, very different to that of cassia or cinnamon. The thickness was a quarter of an inch, and when soaked in water it became very mucilaginous. It afforded, on analysis, distinct reactions for an alkaloid, which had the characters of laurotetanine, a poisonous base lately discovered by Dr. Greshoff in the barks of several species of Javanese lauraceous plants.

About two years ago a collection of drugs for identification was sent to me by Dr. P. S. Mootooswamy, of Tanjore, and among them was a specimen of *Pishin-puttai*, which, he said, was collected from trees growing in the jungles near Point Calimere. This bark had a most agreeable odour, resembling, but not identical with, Indian cassia, and the taste was decidedly sweet. It made a slimy mucilage when mixed with water and contained some tannic acid, but no alkaloid resembling laurotetanine could be separated from it. The bark is sold in the bazaars, and it is known as *Mydalakady* among Muhammadans. It is used in medicine for its mucilaginous, demulcent, and refrigerant properties. By powdering the bark with some benzoin, mixing it into a paste with a little water, and smearing this on reeds, and drying them in the sun, flavouring sticks called *Samboorany-vathe* are made, and are burnt as an incense or perfume. I have not been able to obtain the botanical source of this particular variety of gum-bark, but I am inclined to believe from its odour that it is an arboreous cinnamon.

From Travancore I have received on different occasions three specimens of gum-bark, all varying the one from the other. The first was a thick, red-coloured bark, a commercial article on the Western Coast, supplied to sugar refiners. The botanical origin could not be ascertained; it differed in physical characters from the barks previously mentioned, and yielded an alkaloid having the reactions of laurotetanine. Probably it was a Litsæa. The second description of gum-bark was that of *Kydia calycina*. The third specimen was sent by the Conservator of Forests for Travancore; it was named in Malyalum *Ava-tholi*, and derived, it was supposed, from a species of Cordia.

I have recently examined some samples of gum-barks from the Madura District of Southern India, and stated to be used by the hill villagers in increasing the alcoholic strength of sago toddy. The plants yielding these barks were up to this time only known by their vernacular names, but as leaves, flowers, and fruits were also sent, these enabled them to be identified. The request was also made that they should be analysed to ascertain the nature and effect of their use in native spirit manufacture.

The seven specimens of bark were as follows :—

1. Kadaly-marum*	*Olea glandulifera.*
2. Koppa-marum	*Litsæa Zeylanica.*
3. Karukathan-gundu* ...	*Hiptage Madablota.*
4. Mullu-gundu	*Jasminum flexile.*
5. Pungala-marum	*Ligustrum Roxburghii.*
6. Sudala-marum	*Litsæa Wightiana.*
7. Kumala-marum	*Gmelina arborea.*

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* Marum = tree, gundu = climber (Tamil).

The *Olea glandulifera* is a stout, tall tree, with white flowers and small black fruit. The bark is of a greyish colour, with whitish specks, about $\frac{1}{6}$ of an inch in thickness, breaking with a close granulated fracture, inner surface brown.

The *Litsæa Zeylanica* is a moderate-sized tree, with yellowish-white flowers and black fruit; the leaves are ribbed and whitish on the under surface. The bark is gray and covered with lichens, smooth, $\frac{1}{6}$ of an inch thick, fracture close, showing white, glistening fibres running through the red substance of the middle and inner layers, brown and smooth internally. The bark gives off a fragrant odour when burning.

The *Hiptage Madablota* is a woody climber, reaching to the top of trees over 100 feet high. The stems are from half to three-quarters of an inch in thickness, and covèred with a thin, smooth, reddish-brown bark enclosing a yellowish wood.

The *Jasminum flexile* is also a climber. The stems are about one inch in diameter, very woody and knotted, covered with a light yellowish-brown papery bark, exfoliating on the surface.

The *Ligustrum Roxburghii* is a stout tree about 50 feet in height. The bark is coloured russet-brown, and is a quarter of an inch or more in thickness; fracture close, showing thick white fibres running through the brown middle and inner layers.

The *Litsæa Wightiana* is similar to *L. Zeylanica* in many respects. The bark has a greyish-green epidermis, beneath which is a chocolate-coloured surface; the fracture is short and light coloured, becoming red or brown by exposure to the air.

The *Gmelina arborea* is a common tree in the plains. The bark is about half an inch thick, with a rugged, black and yellowish-brown surface, middle layer hard and brown, fracture granular, ochreous within.

Some documents accompanying these specimens stated that the barks of these trees were used "to increase the intoxicating effects of sago toddy." The bark is simply placed in the toddy and left there for two or three days. The bark No. 3, it is said, is not so frequently used, as the resulting liquor causes headache when drunk. With reference to No. 7, it was said that a tenth part of it would answer the purpose in the absence of other barks.

It will only be necessary to give the results of the chemical examination of these barks, in so far as they are likely to explain their action in the fermentation of sugar. Three of the plants curiously enough belong to the natural order Oleaceæ; these are *Olea glandulifera*, jasminum and ligustrum, and like other plants of this order contain a peculiar bitter principle, soluble in water and alcohol, and a yellow colouring matter called quercetin. Two other barks of the series belong to the same natural family of the laurels, and have a similar composition; these are the Litsæas. The Hiptage bark contains tannin, and is simply an astringent; and the Gmelina belongs to a class of plants distinguished for their bitterness.

The amount of extract dissolved out of the bark by water and alcohol respectively were determined in order to ascertain their relative proportion, as it would seem that in the absence of much resin, the excess of water extract over the spirit extract would indicate mucilaginous matter, and on the barks being placed in the toddy, which in a fresh state is a watery solution of sugar, with some albuminous matter, the extract would dissolve, but as fermentation proceeded, alcohol would be formed and the mucilage would become insoluble and precipitate, carrying down with it the viscid albumen, and thus allow the sugar to ferment more rapidly. From the fact that other gum-barks besides the Litsæas, such as *Kydia calycina* and *Guazuma tomentosa*, are largely used in clarifying sugar, it is evident that some such object as this is intended in their employment. The astringent qualities of most of the above-mentioned barks are no doubt used for the purpose of forming insoluble compounds with albuminous matter in saccharine solutions; just as hops are used to remove this substance from malt liquor in the ordinary process of brewing beer. The hops are found to prevent in a great measure the tendency of the beer to become sour, in consequence of the conversion of alcohol into acetic acid, and in warm climates where such liquors are apt to run into the acetous fermentation very rapidly, it is necessary to employ astringent drugs to regulate the formation of alcohol and prevent the development of acetic acid.

The natives consider these barks a necessary ingredient in making spirit, for the following reasons: Firstly, they diminish the great sweetness of the toddy sugar. Secondly, they render the spirit more intoxicating. The first of these phenomena is accounted for by the chemical fact that sugar breaks up during fermentation into two other bodies, alcohol and carbonic acid; and in the second place the barks enable the operator to obtain a larger proportion of alcohol from his toddy than he could get from leaving it to brew without such adjuncts. The analyses of the barks, with the exception of the Litsæas, which contain laurotetanine, has revealed no principle of poisonous or intoxicating properties, therefore the idea of their directly communicating a potency to the spirit is not sufficiently established, and, besides, as the spirituous liquor is submitted to distillation afterwards, any alkaloid, such as strychnine, would be left behind in the retort. Some of the barks are aromatic, and these most likely are used to flavour the resulting spirit, which would be the case if the aroma resided in a volatile oil. It is probably a spirit of this kind that Dr. Ainslie refers to under the title of *Puttaicharagum*, or bark-spirit, an alcoholic liquor in which barks of various acacias are used in the manufacture. (*D. H.*)

Formosa Camphor.*

Formosa camphor is obtained from the *Laurus camphora*, immense forests of which extend over most of the lower ranges of hills in the island, extending up the lower slopes of the mountains inhabited by the savage tribes. Many of these forests have not been touched, and the statement that the camphor supplies in South Formosa are becoming exhausted, applies only to those districts which are purely Chinese. The supply from other parts is practically inexhaustible. Even in purely Chinese districts it is only at certain places that the supply is falling off in consequence of the reckless manner in which the trees have been destroyed, partly for the sake of the timber and camphor, and partly, no doubt, simply to clear the ground for cultivation.

It has been often stated that the method of obtaining crude camphor in Formosa is by steeping the chopped branches in water, and boiling until the camphor begins to adhere to the stick used for stirring, when the liquor is strained, and by standing the camphor concretes. By this method it does not necessarily follow that the tree is destroyed; in fact, with a little care there is no need that it should be. But although this method may have been in use in former days, it certainly is not now. On the contrary, I am assured by several natives, engaged in the trade, whom I have questioned on the subject, that the yield of camphor from the branches is too small to repay the labour of extraction.

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* From a report by Mr. Consul Warren on the trade of Tainan, Formosa.

The method in general use now is as follows:—The camphor expert selects a tree and scrapes into the trunk in different places, using an instrument somewhat resembling a rake, with the view of ascertaining whether it contains sufficient camphor to repay the labour of extraction. A tree is said not to be worth anything for camphor purposes until it is fifty years' old, and the yield is very unequal; sometimes one side only of the tree contains enough camphor to satisfy the expert, and in this case that side alone is attacked. The trunk is scraped to as great a height as the workmen can conveniently reach, and the scrapings are pounded up and boiled with water in an iron vessel over which an earthenware jar, specially made for the purpose, is inverted. The camphor sublimes and condenses on the jar, which is removed from time to time, scraped, and replaced. The root of the tree and the trunk, for some eight feet up, contain, as a rule, the greatest quantity of camphor. If the scrapings obtained from the trunk yield well, the chipping is continued until in the end the tree falls. The roots are then grubbed up, as it is certain they will give a proportionately good return. If, however, the scrapings do not turn out well, the tree is abandoned, and work is commenced on another. No attempt is made to extract camphor from the fallen trunk or from the branches. In some cases, the trunk is sawn up into timber, but this depends on the locality; from many districts, owing to absence of roads, timber would not pay for its transport.

It is impossible to imagine a more wasteful method of procedure, and it is fortunate that the camphor forests of Formosa are practically inexhaustible.

The quantity of camphor produced depends, of course, simply on the amount of labour employed in the business. Ten of the iron pots mentioned above and their accompanying jars make up what is called a "set," and are worked by four men. One set will produce about 65 lbs. in ten days, or, say, 1¾ cwt. a month, but this only under the most favourable circumstances; a fair average is about 1¼ cwt.

Recently a change has been made in the camphor monopoly. It is now proposed by the Chinese authorities that the camphor stills should be licensed before they are permitted to work. The cost of the license will be equivalent to a tax of about 22*s.* 6*d.* per cwt., a heavy tax, seeing that the actual value of the camphor at the place of production is very little over this amount. (*Pharm. Journ.* June 13th, 1891.)

EUPHORBIACEÆ.

Phyllanthus Niruri.

The bitter principle of this plant, which we provisionally named *pseudo-chiratan*, has been examined by M. Ottow (*Nederl. Tijds. voor Pharm.*, 1891, 3, 128), who calls it *phyllanthin* and gives its chemical composition as $C^{30}H^{37}O^{8}$. It crystallizes in colourless needles or flakes, possesses an intensely bitter taste, and is almost insoluble in water, but easily soluble in alcohol, petroleum ether, ether, chloroform, benzene, and glacial acetic acid. At 200° C. it is volatilized and condenses in the upper part of the vessel as an amorphous mass, but in a few days this amorphous deposit changes to the crystalline state.

Manioc or Cassava.

From the brief allusions to this substance by writers on Materia Medica, one would get but a slight idea of its importance as an article of diet in tropical countries, being the staple-food for unnumbered millions of human beings—the staff of life in the West Indies, Brazil, and on the Continent of Africa.

The plant from which this food is derived is known to botanists as *Janipha Manihot*, and is a shrub six to twelve feet high and one or two inches in diameter. Except for the young leaves, which are used as greens, its whole value consists in its tuberous roots, which sometimes reach the enormous weight of thirty pounds, but usually range from one to three inches in diameter and from six to eighteen inches in length. The shrub is said to be a native of Brazil, where it is known as Mandioca or Tapioca. Cassada (or Cassava) is its name in the West Indies. It is not grown from the seeds, but from cuttings, having surprising vitality; for a cane of it, like Aaron's rod, will bud and grow leaves in your hand. Hence, it is only necessary to cut the stick into pieces of six to twelve inches in length, and thrust them into the ground, and it matters little whether the ground has been first broken for it or not. In eight to eighteen months the tubers are in their best state to produce the nutritious food—seventy per cent. gluten and thirty of starch; but, at a later period, the gluten becomes less and the starch increases. There is no food-product which compares with it in resisting drought. Even in the dryest seasons, it is like other trees "planted by the rivers of water," and whole fields are green with its foliage, while all else is brown with the scorching sun.

There are two varieties of the manioc, known as the sweet and the bitter; the first of which may be eaten with impunity, while the latter has a bitterish, milky juice, which is poisonous from containing prussic acid. But these roots are grated or otherwise reduced to a pomace, and then suspended in grass bags, when the poisonous juice drips out, or, being volatile, is dissipated by the heat in baking bread from it. The bitter variety is the principal kind used in British Guiana, while the sweet is the one mostly cultivated in Africa. The tapioca which comes into our houses is almost pure starch, and is made from the expressed juice of the root, which, on standing, deposits in the form of powder, and which, if dried without heat, will remain so. If heat be applied, it takes the form of the irregular masses we are accustomed to see.

The root has the taste of chestnuts, and may be eaten raw. It is delicious, wholesome food when roasted in hot embers or broiled. If soaked till the skin can be drawn off and the fibrous heart drawn out and then dried, it makes good bread; or, if broken up and fried in palm oil and salted, it is a good relish, and the Africans call it *bomba.*

An extremely white and fine flour, called *fuba,* is made from the soaked and dried roots, and it is the chief food in Angola.

The flour makes a thick porridge or mush—*funje.* The water is boiled and salted and set off the fire; after which *fuba* is stirred in until it can be cut into blocks, which may be taken in the hands and eaten with molasses or dipped into chicken broth.

The staff of life on the Congo is *quanga,* or bread made from the manioc by soaking, peeling, and pounding the soaked root into a pomace, and kneading and making into dough-loaves of four by six or ten inches. These loaves are wrapped in thin, tough leaves and bound, and then boiled in large earthen pots. Then the bread is ready for use; or it may be sliced and browned or broiled, as one prefers.

Farina from the manioc is prepared by grating the green root, drying in the sun, with all the starch and tapioca in it, browning it slowly over the fire; after which it is eaten by stirring it into soup or boiled beans.

9c

Grate, strain, and dry slowly in the sun, and you have a starch for puddings or any other purpose for which starch has demand in the market. Gluten being a nerve-food, indispensable to health and vigour of both body and mind, the great abundance of it in the Cassada—nearly three times as much as in wheat flour—the Cassada is pre-eminently " the staff of life," since there is no way by which its abundance of gluten can be wasted in preparation, as in wheat. There is a Providence here which shapes ends, since this chief food for tropical regions has so much nerve-supplying elements and so little of the heating elements, as compared with food in colder climates.

But this abundant gluten, as compared with other foods for the sick, pre-eminently fits it for the sick-room, and especially so when we wish to increase strength instead of heat, and where any irritating and indigestible food-substances are forbidden. It requires longer boiling than starchy foods in general, and may be used in the form of thin mucilage or demulcent, or in a more solid form with sugar, lemon juice, nutmeg or other aromatics. I suspect that, as physicians, we should make immense gain in restoring from prostrating sicknesses by using more of this eligible substance in place of so much meat slops, and especially so in cases complicated with more or less gastric irritation. Meat foods must be excluded from the stomach in gastric ulcer. Why not, then, fall back upon this highly nitrogenous food for supporting the strength? Having so large a proportion of gluten over the starch, it offers immense advantages over wheaten and other bread in cases of diabetes where any starch at all is allowable. (*By E. Chenery, M.D., of Boston, "The Times and Register,"* April 5th, p. 318.)

In the Cox's Bazar district, Bengal, the tuberous roots are used by the Maghs in the preparation of a spirit.

A false Kamala.

Mr. Henry G. Greenish has examined a sample of Kamala from Bombay, and found it to have been carelessly collected, and mixed with badly preserved safflower and other extraneous matter, and reduced to coarse powder. (*Pharm. Journ.*, March 11th, 1893.)

PHARMACOGRAPHIA INDICA.

INDEX

AND

APPENDIX

TO THE

PHARMACOGRAPHIA INDICA,

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OOTACAMUND.

London;—KEGAN PAUL, TRENCH, TRUBNER & Co., Ld.
Bombay:—EDUCATION SOCIETY'S PRESS, BYCULLA.
Calcutta;—THACKER, SPINK & Co.

1893.